LEARNING MADE EASY

Backyard Homesteading

ALL-IN-ONE

for dummies®
A Wiley Brand

5 Books in one!

Todd Brock

Backyard Homesteading

ALL-IN-ONE

by Todd Brock with

**Bob Beckstrom, Howland Blackiston, Cathy Cromell,
Rik DeGunther, Suzanne DeJohn, Owen E. Dell, The Editors
of the National Gardening Association, Kelly Ewing,
Philip Giroux, Theresa A. Husarik, Amelia Jeanroy,
Rob Ludlow, Marty Nachel, Charlie Nardozzi,
Emily Nolan, Cheryl K. Smith, Paul Simon,
Lance Walheim, Karen Ward, Marni Wasserman,
CN, Ann Whitman, Kimberley Willis, Dave Zook**

for dummies®
A Wiley Brand

Backyard Homesteading All-in-One For Dummies®

Published by: **John Wiley & Sons, Inc.,** 111 River Street, Hoboken, NJ 07030-5774, www.wiley.com

Copyright © 2019 by John Wiley & Sons, Inc., Hoboken, New Jersey

Published simultaneously in Canada

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the Publisher. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at http://www.wiley.com/go/permissions.

Trademarks: Wiley, For Dummies, the Dummies Man logo, Dummies.com, Making Everything Easier, and related trade dress are trademarks or registered trademarks of John Wiley & Sons, Inc. and may not be used without written permission. All other trademarks are the property of their respective owners. John Wiley & Sons, Inc. is not associated with any product or vendor mentioned in this book.

LIMIT OF LIABILITY/DISCLAIMER OF WARRANTY: THE PUBLISHER AND THE AUTHOR MAKE NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS WORK AND SPECIFICALLY DISCLAIM ALL WARRANTIES, INCLUDING WITHOUT LIMITATION WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. NO WARRANTY MAY BE CREATED OR EXTENDED BY SALES OR PROMOTIONAL MATERIALS. THE ADVICE AND STRATEGIES CONTAINED HEREIN MAY NOT BE SUITABLE FOR EVERY SITUATION. THIS WORK IS SOLD WITH THE UNDERSTANDING THAT THE PUBLISHER IS NOT ENGAGED IN RENDERING LEGAL, ACCOUNTING, OR OTHER PROFESSIONAL SERVICES. IF PROFESSIONAL ASSISTANCE IS REQUIRED, THE SERVICES OF A COMPETENT PROFESSIONAL PERSON SHOULD BE SOUGHT. NEITHER THE PUBLISHER NOR THE AUTHOR SHALL BE LIABLE FOR DAMAGES ARISING HEREFROM. THE FACT THAT AN ORGANIZATION OR WEBSITE IS REFERRED TO IN THIS WORK AS A CITATION AND/OR A POTENTIAL SOURCE OF FURTHER INFORMATION DOES NOT MEAN THAT THE AUTHOR OR THE PUBLISHER ENDORSES THE INFORMATION THE ORGANIZATION OR WEBSITE MAY PROVIDE OR RECOMMENDATIONS IT MAY MAKE. FURTHER, READERS SHOULD BE AWARE THAT INTERNET WEBSITES LISTED IN THIS WORK MAY HAVE CHANGED OR DISAPPEARED BETWEEN WHEN THIS WORK WAS WRITTEN AND WHEN IT IS READ.

For general information on our other products and services, please contact our Customer Care Department within the U.S. at 877-762-2974, outside the U.S. at 317-572-3993, or fax 317-572-4002. For technical support, please visit https://hub.wiley.com/community/support/dummies.

Wiley publishes in a variety of print and electronic formats and by print-on-demand. Some material included with standard print versions of this book may not be included in e-books or in print-on-demand. If this book refers to media such as a CD or DVD that is not included in the version you purchased, you may download this material at http://booksupport.wiley.com. For more information about Wiley products, visit www.wiley.com.

Library of Congress Control Number: 2019936496

ISBN 978-1-119-55075-4 (pbk); ISBN 978-1-119-55079-2 (ebk); ISBN 978-1-119-55077-8 (ebk)

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

Contents at a Glance

Introduction 1

Book 1: Creating a Garden 5

CHAPTER 1: Planning Your Garden 7
CHAPTER 2: Deciding What to Grow 41
CHAPTER 3: Preparing to Plant. 65
CHAPTER 4: Planting 95
CHAPTER 5: Growing Your Garden 125
CHAPTER 6: Dealing with Weeds and Pests 155
CHAPTER 7: Extending Your Season 171

Book 2: Preserving the Harvest 181

CHAPTER 1: Canning Basics 183
CHAPTER 2: Water-Bath Canning. 197
CHAPTER 3: Pressure Canning 231
CHAPTER 4: Pickling 269
CHAPTER 5: Freezing 291
CHAPTER 6: Drying 319
CHAPTER 7: Root Cellaring and Storage 357

Book 3: Making Your Own 369

CHAPTER 1: Brewing Beer. 371
CHAPTER 2: Fermenting 389
CHAPTER 3: Baking Bread 425
CHAPTER 4: Making Candles and Soap. 441

Book 4: Raising Animals 455

CHAPTER 1: Introducing Beekeeping 457
CHAPTER 2: Caring for Your Bee Colony 473
CHAPTER 3: Introducing Backyard Chickens 509
CHAPTER 4: Raising Your Chicken Flock 529
CHAPTER 5: Opting for Other Animals 553

Book 5: Building It Yourself 559

CHAPTER 1: Starting Small with Garden Projects 561
CHAPTER 2: Building a Backyard Beehive 581
CHAPTER 3: Building a Chicken Coop 603

Index 631

Recipes at a Glance

Baking Bread

Amish Applesauce Bread . . . 437
Basic White Buttermilk Bread . . . 433
Blueberry Muffins . . . 439
Buttermilk Biscuits . . . 440
Fluffy Dinner Rolls . . . 436
Honey-Oatmeal Bread . . . 434
Jeff's Potato Bread . . . 435
Southern Corn Bread . . . 438

Drying

Dried Apples . . . 330
Dried Apricots . . . 331
Dried Beets . . . 343
Dried Blueberries . . . 332
Dried Carrots . . . 344
Dried Cherries . . . 333
Dried Citrus Peel . . . 334
Dried Greens . . . 345
Dried Peas . . . 346
Dried Pineapple . . . 335
Dried Potatoes . . . 347
Dried Shell Beans . . . 342
Fruit Leather . . . 336
Sweet Potato Crunch Sticks . . . 348
Zucchini Chips . . . 349

Fermenting

Chevre (Goat Cheese) . . . 414
Cottage Cheese . . . 413
Fermented Garden Vegetables . . . 399
Garlic Dilly Beans . . . 400
Ginger Soda . . . 419
Green Tea Kombucha . . . 423
Homemade Yogurt . . . 410
Honey Kombucha . . . 424
Kefir . . . 411
Kimchi . . . 398
Koumiss . . . 412
Mozzarella . . . 415

Root Beer .421
Sauerkraut .396
Sourdough Starter .403
Spinach Sauerkraut .397
Traditional Sourdough Bread .404
Vanilla Cinnamon Coconut Kefir .422

Freezing

Frozen Apples Packed in Sugar .299
Frozen Bell Peppers .307
Frozen Broccoli .308
Frozen Brussels Sprouts .309
Frozen Cauliflower .310
Frozen Corn .311
Frozen Greens .312
Frozen Peaches Packed in Syrup .301
Frozen Shelled Peas .313
Frozen Strawberries Packed in Sugar .302
Frozen Summer Squash .314
Frozen Wax Beans .306
Frozen Winter Squash .315
Quick-Frozen Blueberries .300

Pickling

Dilly Beans .285
Pickled Asparagus .284
Pickled Brussels Sprouts .289
Speedy Dill Pickles .280
Spiced Pickled Beets .287
Sweet Pickle Relish .278
Zucchini Bread and Butter Pickles .282

Pressure Canning

Canned Asparagus .251
Canned Beets .253
Canned Bell Peppers .255
Canned Carrots .256
Canned Corn .258
Canned Creamed Corn .260
Canned Fresh Green Beans .252
Canned Onions .262
Canned Peas .264
Canned Summer Squash .267
Canned Sweet Potatoes .266
Canned White Potatoes .265

Water-Bath Canning

Apple Pie Filling 215
Applesauce 216
Canned Apples 214
Canned Apricots, Nectarines, and Peaches 217
Canned Blueberries 220
Canned Raspberries 219
Canned Tomatoes. 221
Green Tomato Chutney 226
Jalapeño Salsa 229
Strawberry-Rhubarb Jam 225
Summer Squash Relish 227
Tomato Paste 222

Table of Contents

INTRODUCTION 1
About This Book. 1
Foolish Assumptions. 2
Icons Used in This Book 2
Beyond the Book 3
Where to Go from Here 3

BOOK 1: CREATING A GARDEN 5

CHAPTER 1: **Planning Your Garden** 7
Determining Location and Size 8
  Acclimating to your conditions 9
  Factoring in microclimates 11
  Considering different sites 12
  Letting the sun shine on your plot 13
  Checking your soil's drainage 14
Deciding On a Layout 15
  Looking at hills, rows, or raised beds 15
  Spacing your plantings properly 17
  Following the paths 18
  Sketching it out 18
Thinking Outside the Garden Bed. 19
  Going vertical 19
  Container vegetables 21
  Vertical containers. 23
Keeping Critters Out 26
  Deer 27
  Rabbits 29
  Groundhogs 30
  Gophers 30
  Mice and voles 31
  Raccoons. 32
  Squirrels 32
  Birds 32
Assembling Tools. 33
  Watering hoses and cans 34
  Hand trowels 34
  Hand cultivators. 35
  Garden hoes. 35
  Spades and shovels. 36
  Garden forks 36

Garden rakes 38
Buckets, wagons, and baskets 38
Wheelbarrows and garden carts 39
Power tillers 39

CHAPTER 2: **Deciding What to Grow** 41
Understanding Veggie Varieties 41
Deciding How Much to Grow 43
Supplementing your grocery needs and sharing with friends 44
Selling at the market 44
Going all the way to a subsistence-level operation 45
Succeeding with Vegetables 45
Cucumbers, melons, and squashes 46
Legumes, the nitrogen-fixers 48
Tomatoes and peppers: The not-so-deadly nightshades 49
Corn 51
Leaf crops and cruciferous veggies 52
Root crops and tubers 54
Stem crops 57
Planting Other Small-Scale Crops 58
Letting business bloom with flower gardens 59
Aiming higher with fruit- and nut-bearing trees 59
Growing berries and grapes: Fruit bushes and vines 60
Growing Herbs for and in the Kitchen 62

CHAPTER 3: **Preparing to Plant** 65
Razing Your Garden Spot 66
Killing weeds and aggressive grasses 67
Stripping sod 69
Analyzing and Improving Your Soil 69
Distinguishing different types of soil 70
Testing your soil 71
Adjusting soil pH 73
Turning Your Soil 77
Looking Ahead at Watering Options 79
Furrows 79
Basins 80
Hoses 80
Sprinklers 81
Soaker-hose irrigation 82
Drip irrigation 82
Harvesting rainwater in a barrel 84
Fencing It In 86
Building the fence 87
Planning for Pathways 94

CHAPTER 4: Planting

CHAPTER 4: Planting 95
Timing Your Planting Wisely 96
  Some like it cool, some like it hot 96
  Frost dates and the length of the growing season 97
Choosing Seeds or Transplants 102
Deciding on Your Seeding Method and Decoding a Seed Packet . . . 103
Starting Seeds Indoors 104
  Picking a pot to plant in 105
  Using a mix that doesn't include soil 106
  Sowing your seeds 107
  Providing the right amount of light and heat 108
  Watering your seedlings 109
  Thinning and transplanting indoors 111
  Feeding your seedlings 111
Transplanting Indoor Seedlings and Starter Plants 112
  Buying starter plants 112
  Toughening up all types of transplants 113
  Making the big move to the ground 114
Sowing Seeds Directly in Your Garden 116
  Deciding on a seed-planting method 116
  Thinning seedlings in your garden 120
Planting Guidelines 120

CHAPTER 5: Growing Your Garden 125
Introducing Your Inner Gardener to the Watering Basics 126
  Following guidelines for watering seeds and plants 126
  Knowing when your veggies need a drink 127
Digging Into Composting 128
  Buying bagged compost 129
  Buying compost in bulk 129
  Compost happens: making your own 130
Fertilizing Your Vegetable Garden 135
  Examining a fertilizer label 135
  Choosing a fertilizer 136
  Side-dressing 137
Keeping Your Plants Cozy and Weed Free with Mulch 140
  Spreading organic mulch 140
  Laying inorganic mulch 142
  Deciding which mulch to use 144
Surveying Some Cool Farmer Techniques 145
  Adding nutrients and stability with cover crops and green manures 145

Making your garden work double time with intercropping 148
Succession planting for an extended harvest.................148
Planting by the phases of the moon.........................151
Knowing When to Harvest......................................151

CHAPTER 6: **Dealing with Weeds and Pests** 155
Fighting Weed Wars 156
Making a preemptive strike on weeds.........................156
Battling weeds after planting...............................157
Using herbicides smartly 157
Keeping Good Bugs Nearby.....................................158
Battling Bad Bugs 159
Aphids..159
Caterpillars and worms 160
Corn earworms 161
Cutworms..161
Flea beetles..162
Japanese beetles 162
Nematodes...163
Snails and slugs..163
Spider mites..163
Thrips..164
Whiteflies 164
More Methods of Attack.......................................164
Physical controls 164
Safe pesticides...165
Giving your plants some friends: companion planting 167
Rotating crops 169

CHAPTER 7: **Extending Your Season**..............................171
Covering Your Rows 172
Using Cold Frames 173
Going with Greenhouses 175
Getting Your Feet Wet with Hydroponics, Aquaponics, and Aeroponics.....178
Hydroponics...178
Aquaponics..179
Aeroponics 179

BOOK 2: PRESERVING THE HARVEST 181

CHAPTER 1: **Canning Basics**.....................................183
Starting Successful Canning..................................183
Gathering Your Canning Gear.................................185
Canning vessels...185
Canning tools...185

Putting Safety First 191
  Packing your jars with care 191
  Knowing the acidity level of your food 193
  Adjusting your altitude 194
  Detecting spoiled foods 194

CHAPTER 2: **Water-Bath Canning** 197
Water-Bath Canning in a Nutshell. 197
Gearing Up for Water-Bath Canning. 198
Water-Bath Canning Step-by-Step 200
  Step 1: Getting your equipment ready. 200
  Step 2: Readying your food 202
  Step 3: Filling your jars 203
  Step 4: Processing your filled jars 203
  Step 5: Removing your filled jars and testing the seals 204
  Step 6: Storing your canned food 206
Adjusting Your Processing Times at High Altitudes 206
Canning Fresh Fruit (Yes, That Includes Tomatoes) 207
  Identifying the proper degree of ripeness. .208
  Deterring discoloration. 208
  Raw pack and hot pack. 209
  Lining your jars with liquid. 209
Fresh Fruit Canning Recipes. 211
  Apples 211
  Apricots, nectarines, and peaches 212
  Berries (except strawberries). 212
  Tomatoes 213
Jam, Chutney, Relish, and Salsa Recipes 223
  Jamming out 223
  Making great accompaniments 224

CHAPTER 3: **Pressure Canning**. 231
Understanding the Fuss about Low-Acid Foods 232
Choosing a Pressure Canner 232
  Covers 234
  Gauges 235
  Vent tube, pipe vent, or petcock 236
  Overpressure plug. 237
  Rack 237
Pressure Canning Step-by-Step. 238
  Step 1: Gearing up. 238
  Step 2: Preparing your food. 239
  Step 3: Filling your jars 239
  Step 4: Placing the jars in the canner 240
  Step 5: Closing and locking the canner 240

Step 6: Processing your filled jars 241
Step 7: Releasing the pressure after processing. 241
Step 8: Removing and cooling the jars 241
Step 9: Testing the seal and storing your bounty 242
Pressure Canning at Higher Altitudes 242
Canning Vegetables. 243
Picking the perfect produce 243
Vegetables not recommended for pressure canning 244
Cleaning your vegetables 244
Raw packing versus hot packing 245
Vegetable Canning Recipes 246
Asparagus 247
Beans. 247
Beets 247
Bell peppers (green, red, orange, yellow) 248
Carrots. 248
Corn 249
Onions. 249
Peas 249
Potatoes 249
Summer squash. 250

CHAPTER 4: **Pickling** 269
Perusing Pickling Ingredients. 269
Salt 270
Vinegar 270
Water. 271
Herbs and spices 271
Brining Education 272
Fresh (or raw) packing: Adding brine to the raw veggies. 272
Complete precooking 272
Brining before canning 272
Adding Crunch to Your Food 274
Pickling Equipment and Utensils. 275
Pickled Vegetable Recipes 275
Pickled toppers 275
Pickles 275
Pickled vegetables 276

CHAPTER 5: **Freezing** 291
Focusing on Freezing 291
Temperature: the cold, hard facts. 292
Packaging foods for freezing 292
Warming up to thawing out 294
Rethinking refreezing 295

Giving Fruit the Freeze 295
  Preparing your fruit. 295
  Syrup concentrations at a glance 296
  Headspace guidelines. 297
Frozen Fruit Recipes 298
  Apples 298
  Berries. 298
  Peaches, nectarines, and apricots. 298
  Strawberries. 298
Blanching Perfect Vegetables 303
Frozen Vegetable Recipes 304
  Beans. 304
  Bell peppers 304
  Broccoli 304
  Brussels sprouts 304
  Cauliflower 305
  Corn. 305
  Greens. 305
  Peas 305
  Summer squash. 305
  Winter squash 305
Freezing Fresh Herbs 316

CHAPTER 6: **Drying**. 319
Opening the Door to Successful Food Drying 319
Choosing a Drying Method 320
  An electric dehydrator 320
  A conventional oven 322
  The sun 323
Protecting the Life of Your Dried Food. 324
Snacking on the Run: Drying Fruit. 325
  Cutting it down. 326
  Pretreating your fruit 326
  Enjoying the labors of your drying 327
Dried Fruit Recipes 328
  Apples 328
  Apricots. 328
  Blueberries. 329
  Cherries. 329
  Citrus. 329
  Pineapple 329
  Puréed fruit 329
Drying Vegetables for Snacks and Storage 338
  Drying know-how. 338
  Storing and using your dried produce 339

Dried Vegetable Recipes 340
  Shell beans 340
  Beets 340
  Carrots 340
  Greens 340
  Peas 341
  Potatoes 341
  Zucchini 341
DIYing the Drying of Herbs 350
  Chamomile 350
  Dill 352
  Mint 353
  Oregano 353
  Rosemary 354
  Sage 355
  Thyme 355

CHAPTER 7: **Root Cellaring and Storage** 357
Finding the Perfect Place for Cold Storage 357
  Tried and true: The traditional root cellar 359
  DIY storage spaces 359
Following Simple Storage Rules 362
Preparing Foods for Cold Storage 364
  Apples 364
  Beets 365
  Cabbage 365
  Carrots 366
  Garlic 366
  Onions 366
  Pears 367
  Potatoes 367
  Turnips 368
  Tomatoes 368

BOOK 3: MAKING YOUR OWN 369

CHAPTER 1: **Brewing Beer** 371
Setting Up Shop to Brew 372
Getting to Know Your Ingredients 374
  Grain 374
  Hops 374
  Yeast 375
  Water 376

Brewing Your First Batch 377
Taking Hydrometer Readings 380
    Brewing day reading 382
    Prebottling reading 382
Bottling Your Brew 383

CHAPTER 2: **Fermenting** 389
Getting Familiar with Fermentation 389
Fermenting Essentials. 390
Cleaning, Sanitizing, and Sterilizing 392
Fermenting Vegetables (including Sauerkraut and Kimchi) 393
    Preparing your vegetables 394
    Salting 394
    Packing the jars 394
    Waiting and tasting (and waiting some more!) 395
Starting Sourdough 401
    Feeding your sourdough starter with tender loving care 401
    Choosing the type of sourdough starter to use 402
Mooving On to Dairy 405
    Making lactose tolerable by fermenting 405
    Choosing pasteurized or raw milk 406
    Sourcing your starter cultures 407
    Serving and storing fermented dairy products 407
    Trying your hand at cheese 408
Raising a Glass to Fermented Beverages 416
    Starting with starters. 416
    Getting fizzy with it: carbonated drinks 417

CHAPTER 3: **Baking Bread** 425
Understanding Yeast Breads 425
    Yeast 426
    Flour 426
    Sweeteners 427
    Salt 428
    Fat 428
    Eggs 428
    Liquids 428
Mixing and Kneading Breads 428
Encouraging Bread to Rise 430
Shaping and Baking the Loaves. 431
Yeast Bread, Quick Bread, Muffin, and Biscuit Recipes 432

CHAPTER 4: **Making Candles and Soap** 441
Igniting Your Candlemaking Hobby 442
  Waxing about the types of waxes 442
  Finding the right wick 443
Rolling Beeswax Candles 444
Making Molded Candles 445
Taking a Dip with Tapers 447
Cleaning Up with Homemade Soap 450
  Making hand-milled soap 450
  Making melt-and-pour soap 452
  Enhancing your soap with additives 452

BOOK 4: RAISING ANIMALS 455

CHAPTER 1: **Introducing Beekeeping** 457
Breaking into Backyard Beekeeping 458
  Environmental considerations 458
  Zoning and legal restrictions 459
  Costs and equipment 459
  How many hives do you need? 460
  What kind of honey bees should you raise? 460
  Time and commitment 460
  Stings and allergies 460
  Dealing with nervous neighbors 461
Choosing the Right Hive 461
  Langstroth hive 462
  Kenyan top bar hive 463
  Warré (people’s) hive 464
  Five-frame nuc hive 466
Gearing Up for Beekeeping 467
  Bee-proof clothing 467
  Fundamental tools 469

CHAPTER 2: **Caring for Your Bee Colony** 473
Busying Yourself with Bee Activity 474
  Lazy, hazy, crazy days of summer 474
  Falling leaves point to autumn chores 475
  Clustering in a winter wonderland 476
  Spring is in the air 478
  Reversing hive bodies 480
  Expanding the brood nest 481

Holding Out for Honey 481
  Having realistic expectations 482
  Assembling the essential extracting equipment 483
Harvesting Your Honey 485
  Knowing when to harvest 485
  Planning your extracted honey harvest setup 486
  Getting the bees out of the honey supers 487
  Honey extraction from a Langstroth frame 489
  Harvesting honey from your top bar hive 492
Swarming and Absconding 496
  Swarming 496
  Absconding 498
Playing Doctor: Fighting Disease 498
  Medicating or not? 498
  Knowing the big six bee diseases 499
Battling Varroa Mites 502
Colony Collapse Disorder 506

CHAPTER 3: Introducing Backyard Chickens 509
Thinking Through Chickenkeeping 510
  Dealing with legal issues 510
  Assessing your capabilities: basic chicken care and requirements 510
  Focusing your intentions: specific considerations 512
Chicken Breeds 516
  If you want it all: dual-purpose breeds 517
  For egg lovers: laying breeds 518
  Best breeds for the table 523
Analyzing the Anatomy of a Coop 525
  Providing the basics 525
  Figuring out features 526

CHAPTER 4: Raising Your Chicken Flock 529
Feeding Your Flock 529
  Nutritional needs 530
  Choosing the right commercial feed 531
  Selecting a form of feed 533
  Supplementing diets with grit 534
  Deciding when to put out feed 534
  Determining how much to feed 535
  Hydrating your hens (and roosters) 535

Raising Baby Chicks. 536
  The basics of brooders 537
  Helping a hen provide warmth and protection. 540
  Feeding and watering chicks 541
  Chicks and children 543
Pests and Predators 544
  Preventing pests 544
  Protecting from predators 546
Expecting Eggs (for Eating). 549
  Providing encouragement 549
  Getting your eggs in one basket 550
  Cleaning your cache 551
  Storing and handling eggs 551

CHAPTER 5: Opting for Other Animals 553
Raising Rabbits. 554
Getting Your Goats 555
Figuring Out Fowl: Ducks, Geese, and Turkeys 556
  Ducks and geese 556
  Turkeys 558
Goin' Fishin'. 558

BOOK 5: BUILDING IT YOURSELF. 559

CHAPTER 1: Starting Small with Garden Projects 561
Making an A-Frame Trellis 562
Crafting the Ultimate Tomato Cage 563
Building Raised Garden Beds 565
Constructing a Cold Frame. 567
Elevating Your Rain Barrel on a Stand 568
Organizing Made Easy with a Tool Wall 570
Creating a Compost Bin (or Two) 573
  Using wood shipping pallets 573
  Wood and wire three-bin composter 574
Whipping Up a Walk-In Hoop House 578

CHAPTER 2: Building a Backyard Beehive 581
Choosing Materials 582
  The best woods for beehives. 582
  Sizing up lumber 583
  Getting the scoop on plywood. 584
  Rifling through roofing materials 585
  Selecting screening materials 586

Protecting Your Hive with Paint and More 586
Building the Kenya Top Bar Hive 587
  Vital stats. 590
  Materials list 590
  Cut list 591
  Elevated hive stand 592
  Hive body 594
  Top bars 596
  Ventilated roof 597
  Assembling the hive 598

CHAPTER 3: **Building a Chicken Coop** 603
Choosing Materials 604
  Boards 604
  Sheet goods 605
  Flooring 607
  Walls 608
  Roofing 608
  Fencing in a chicken run 610
Selecting the Right Coop for Your Flock 611
  A-frames and hoops 612
  Chicken tractors 613
  All-in-one-coops 614
  Walk-in coops 615
Constructing the Alpine A-Frame Coop 616
  Vital stats. 616
  Materials list 617
  Cut list 618
  Assembling the coop 628

INDEX 631

Introduction

Feeding your family with what comes from your little piece of land. Making your own. Doing it yourself. Buying less. Being more self-sufficient. That's what backyard homesteading is all about.

A lot goes into backyard homesteading. It's a hobby for some, and a lifestyle for many. And it's increasing in popularity, as people from all types of backgrounds feel an urge to reconnect with a simpler time, the earth, and their roots. There was a time when families who grew their own vegetables, preserved their own food, and raised their own chickens weren't the least bit extraordinary. But those activities fell out of favor as society continued its never-ending search for bigger, faster, easier. Now these activities are returning to a mainstream society that lost sight of their value.

If you've considered joining that growing movement — even with just the smallest of steps — *Backyard Homesteading All-In-One For Dummies* is for you. Here, you learn how to get started, how to succeed, and how to make the homesteading spirit an integral part of your everyday life.

About This Book

Backyard Homesteading All-In-One For Dummies breaks down the various components most often associated with backyard homesteading: growing food, preserving the harvest, making your own food and other products, raising animals, and building items that help you keep doing those other things. The goal is to walk you through each topic step by step so you can start from scratch if you're a newbie, or brush up with a quick reference if you already have some experience.

As you read, you'll find the following:

- Background information and special considerations to factor in before you embark on a new aspect of homesteading
- Recommended tools, equipment, and gear to do the job correctly and safely
- Potential problems to look for and how to avoid or resolve them

- Assembly instructions and building plans that give you a solid baseline for a project, but can usually be adapted or modified to suit your unique situation
- Recipes that help you get started in the kitchen, but are by no means the extent of what you can do with what comes out of your garden

This book is your entry guide to the world of backyard homesteading, a launching point for a lifelong adventure that will evolve along with you the longer you pursue it.

Foolish Assumptions

In compiling the content for this book, some general assumptions have been made about you, the reader:

- You have enough property to make homesteading a worthwhile endeavor. You can homestead on acres of rolling pasture or in a small backyard in a suburban neighborhood. If you live in a high-rise apartment with a tiny balcony, though, you can adapt bits of information in this book, but "backyard homesteading" might be a stretch.
- You have some experience with gardening and are interested in growing food beyond a single potted tomato plant or one modest vegetable bed.
- You know your way around the kitchen and can follow the basic conventions of recipes, even if more advanced techniques such as pressure canning, pickling, and fermenting are new to you.
- You have an interest in being more self-sufficient by utilizing your own property and skills to produce things you and your family will consume.
- You are at least modestly handy or willing to become so. No one expects you to be able to build your own pole barn after reading this book, but homesteaders are typically resourceful folks who aren't afraid to roll up their sleeves and tackle whatever is required to do the job.

Icons Used in This Book

TIP

The Tip icon marks tips (duh!) and shortcuts that you can use to make your efforts as a homesteader easier.

REMEMBER

Remember icons mark the information that's especially important to know. To discover the most important information in each chapter, skim through these icons.

TECHNICAL STUFF

The Technical Stuff icon marks information of a highly technical nature that you can normally skip.

WARNING

The Warning icon tells you to watch out! It highlights important safety information or marks other details that may save you considerable headaches.

Beyond the Book

Often, you'll need to recall a specific piece of information at a time when this book isn't handy. An accompanying cheat sheet online can be accessed anytime by any Internet-ready device.

You can go to `www.dummies.com/cheatsheet/backyardhomesteadingaio` for a comprehensive planting guideline, perfect for when you're planning or laying out your garden at the beginning of the season. You'll also find a quick step-by-step refresher on the steps for both water-bath canning and pressure canning, easy to call up when you're in the kitchen ready to get to work on a batch of tomato sauce. And a convenient chicken coop checklist helps you ensure that the structure you're either looking at purchasing or thinking about building will fit the needs of your flock.

Where to Go from Here

Instructions for various homesteading techniques and projects can be found throughout the book. If you're starting a garden from scratch, though, Book 1, Chapter 1 is the best place to begin. If you already have a garden up and running and want to start canning and preserving, go right to Book 2.

Book 3 is loaded with recipes that help you expand your homesteading horizons to fermenting food, brewing beer, and baking bread. Considering backyard bees or chickens? Book 4 has you covered with no need to read the previous minibooks.

Book 5 details miscellaneous projects and step-by-step building plans for a few larger specialty builds, too.

1

Creating a Garden

Contents at a Glance

CHAPTER 1: Planning Your Garden 7
Determining Location and Size 8
Deciding On a Layout 15
Thinking Outside the Garden Bed 19
Keeping Critters Out 26
Assembling Tools 33

CHAPTER 2: Deciding What to Grow 41
Understanding Veggie Varieties 41
Deciding How Much to Grow 43
Succeeding with Vegetables 45
Planting Other Small-Scale Crops 58
Growing Herbs for and in the Kitchen 62

CHAPTER 3: Preparing to Plant 65
Razing Your Garden Spot 66
Analyzing and Improving Your Soil 69
Turning Your Soil 77
Looking Ahead at Watering Options 79
Fencing It In 86
Planning for Pathways 94

CHAPTER 4: Planting 95
Timing Your Planting Wisely 96
Choosing Seeds or Transplants 102
Deciding on Your Seeding Method and Decoding a Seed Packet 103
Starting Seeds Indoors 104
Transplanting Indoor Seedlings and Starter Plants 112
Sowing Seeds Directly in Your Garden 116
Planting Guidelines 120

CHAPTER 5: Growing Your Garden 125
Introducing Your Inner Gardener to the Watering Basics 126
Digging Into Composting 128
Fertilizing Your Vegetable Garden 135
Keeping Your Plants Cozy and Weed Free with Mulch 140
Surveying Some Cool Farmer Techniques 145
Knowing When to Harvest 151

CHAPTER 6: Dealing with Weeds and Pests 155
Fighting Weed Wars 156
Keeping Good Bugs Nearby 158
Battling Bad Bugs 159
More Methods of Attack 164

CHAPTER 7: Extending Your Season 171
Covering Your Rows 172
Using Cold Frames 173
Going with Greenhouses 175
Getting Your Feet Wet with Hydroponics, Aquaponics, and Aeroponics 178

IN THIS CHAPTER

- **Siting your garden on your property and organizing its layout for best results**
- **Squeezing out every square foot of growing space**
- **Safeguarding against critters**

Chapter 1

Planning Your Garden

A lush, bountiful vegetable garden is the centerpiece of any backyard homestead. Everyone loves good food. And what better way to have fresh, tasty, and nutritious food than to grow it yourself? You don't have to be a farmer to do so either. Whether you have a plot of land in the yard that's tilled to grow vegetables, a few vegetables planted amongst your flowers and shrubs, or containers loaded with attractive, edible choices, growing your own food is a satisfying and rewarding activity.

But vegetable gardening isn't just about taste. It's about safe food that's produced close to home. It's about knowing what has been sprayed on that food. It's about feeding your friends and family nutritious food high in vitamins and *antioxidants* (cancer-fighting compounds). It's about connecting with your neighbors and community as you experiment with ethnic dishes using exotic ingredients grown in your not-so-exotic backyard. It's about reducing pollution and global warming by not buying produce that's shipped hundreds of miles to your local grocery store. Finally, it's about getting in touch with nature and reclaiming your ability to grow some of your own food, even if it's a container of basil, to be more self-reliant in your little corner of the world. (And that's pretty much why you're interested in backyard homesteading to begin with, right?)

This chapter is all about conceptualizing the garden that your homestead will be built around.

Determining Location and Size

When considering where to plop down your plot, think of these three main elements, which are necessary for the perfect spot: site, sun, and soil. The following sections describe each of these and give you some things to think about when surveying your yard for the best possible spot for your plot. Figure 1-1 puts some of these ideas into visual perspective.

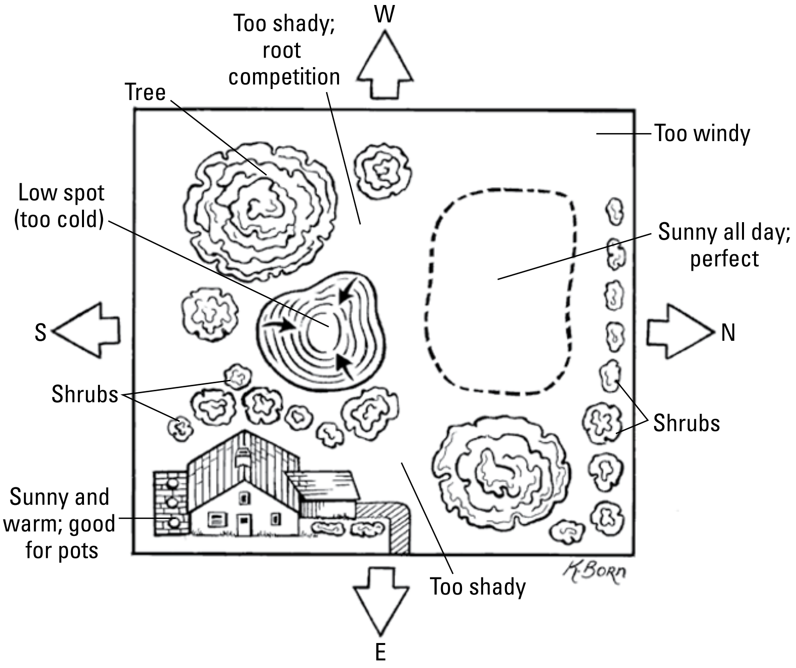

W
Too shady; root competition
Tree
Too windy
Low spot (too cold)
Sunny all day; perfect
S
N
Shrubs
Shrubs
Sunny and warm; good for pots
Too shady
E
K.Born

FIGURE 1-1: A sample yard with possible (and impossible) sites for a vegetable garden.

Illustration by Kathryn Born

REMEMBER

Don't be discouraged if you lack the ideal garden spot — few gardeners have one. Just try to make the most of what you have.

Acclimating to your conditions

The first step in planting wisely is understanding your region's climate, as well as your landscape's particular attributes. Then you can effectively match plants to planting sites.

Don't use geographic proximity alone to evaluate climate. Two places near each other geographically can have very different climates if one is high on a mountainside and the other is on the valley floor, for example. Also, widely separated regions can have similar climates.

USDA Plant Hardiness Zone Map

Low winter temperatures limit where most plants will grow. After compiling weather data collected over many years, the U.S. Department of Agriculture (USDA) divided North America, Europe, and China into 11 zones. Each zone represents an expected average annual minimum temperature.

On the USDA Plant Hardiness Zone Map for North America (see Figure 1-2), each of the 11 zones is 10°F warmer or colder in an average winter than the adjacent zone. The warmest zone, Zone 11, records an average low annual temperature of 40°F or higher. In Zone 1, the lowest average annual temperature drops to minus 50°F or colder. Brrr!

Zones 2 through 10 on some North American maps are further subdivided into *a* and *b* regions. The lowest average annual temperature in Zone 5a, for example, is 5°F warmer than the temperature in Zone 5b. When choosing plants that are just barely hardy in your zone, knowing whether your garden falls into the *a* or *b* category can ease your decision. After a few years of personal weather observation in your own garden, you'll have a pretty clear idea of what to expect for winter low temperatures too.

TIP

Most books, catalogs, magazines, and plant labels use the USDA zone system. For a color version, which may be a bit easier to read, visit the U.S. National Arboretum website, which offers a map of North America and individual regions at `www.usna.usda.gov/Hardzone/index.html`.

REMEMBER

The USDA map is based on a single factor: a region's average minimum winter temperature. Many other factors affect a plant's ability to thrive in a particular environment, so use the map only as a guideline.

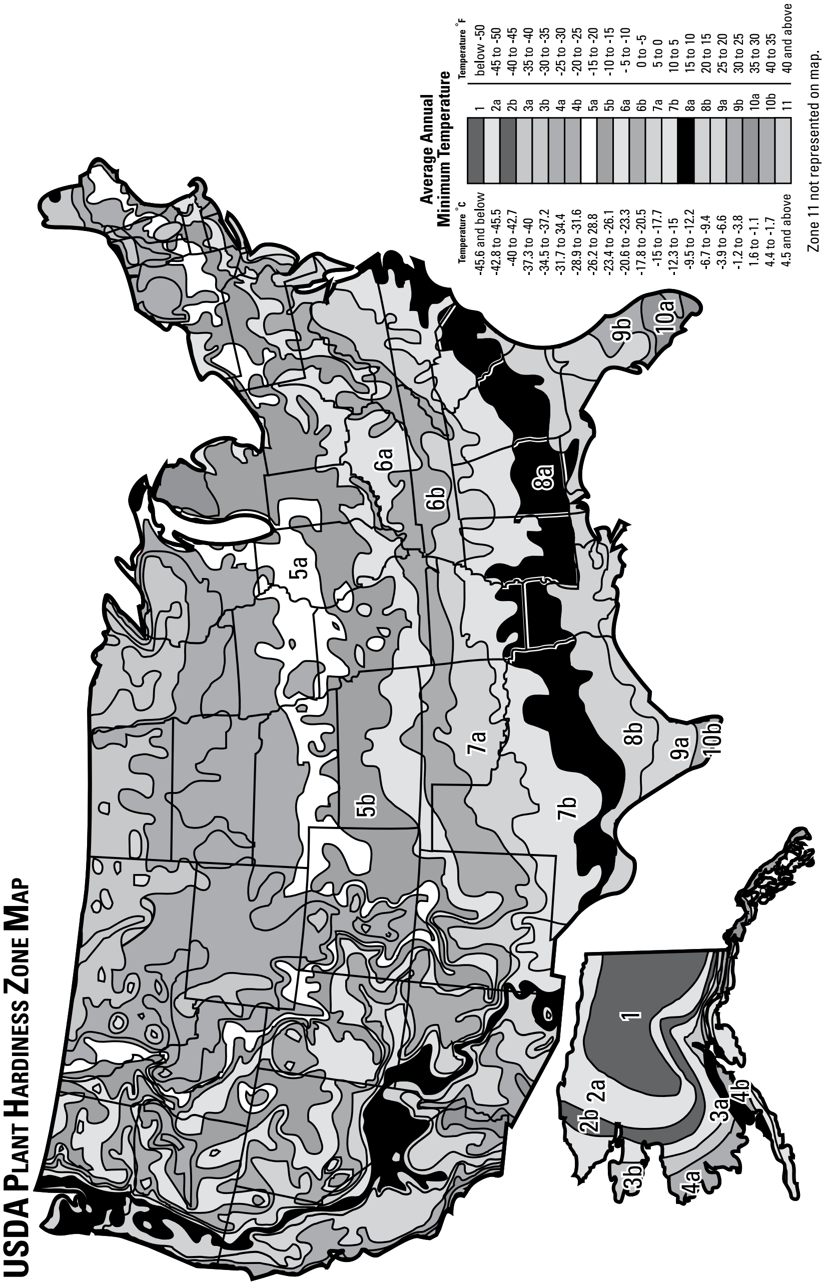

USDA Plant Hardiness Zone Map
Average Annual Minimum Temperature
Temperature °C
-45.6 and below
-42.8 to -45.5
-40 to -42.7
-37.3 to -40
-34.5 to -37.2
-31.7 to 34.4
-28.9 to -31.6
-26.2 to 28.8
-23.4 to -26.1
-20.6 to -23.3
-17.8 to -20.5
-15 to -17.7
-12.3 to -15
-9.5 to -12.2
-6.7 to -9.4
-3.9 to -6.6
-1.2 to -3.8
1.6 to -1.1
4.4 to -1.7
4.5 and above
1
2a
2b
3a
3b
4a
4b
5a
5b
6a
6b
7a
7b
8a
8b
9a
9b
10a
10b
11
Temperature °F
below -50
-45 to -50
-40 to -45
-35 to -40
-30 to -35
-25 to -30
-20 to -25
-15 to -20
-10 to -15
- 5 to -10
0 to -5
5 to 0
10 to 5
15 to 10
20 to 15
25 to 20
30 to 25
35 to 30
40 to 35
40 and above
Zone 11 not represented on map.
5a
5b
6a
6b
7a
7b
8a
8b
9a
9b
10a
10b
1
2a
2b
3a
3b
4a
4b

FIGURE 1-2: The USDA Plant Hardiness Zone Map indicates each zone's expected average annual minimum temperature.

AHS Heat Zone Map

To help gardeners in warm climates, the American Horticultural Society developed the AHS Heat Zone Map. This map divides the United States into 12 zones based on the average number of *heat days* each year — days that reach temperatures of 86°F or higher. Zone 1 has fewer than one heat day per year; Zone 12 has more than 210.

Order your own color poster of the AHS Heat Zone Map by calling the society at (800) 777-7931, ext. 137. Or visit the American Horticulture Society's website at `www.ahs.org/publications/heat_zone_map.htm` for more information and a downloadable map. The site also offers a Heat Zone Finder to locate your particular heat zone by zip code.

Sunset map

In an attempt to take total climate into consideration when evaluating plant hardiness, Sunset Publishing created Sunset's Garden Climate Zones, a map that divides the country into 24 zones. This map is especially useful to gardeners in the western United States, where mountains, deserts, and coastal areas create wildly diverse climates, sometimes within a few miles of each other.

Although most national plant suppliers and references use the USDA zone map, regional garden centers and growers in the western half of the country often refer to the Sunset map. View it at `www.sunset.com/sunset/garden/article/1,20633,845218,00.html`.

Factoring in microclimates

Within larger climates, smaller pockets exist that differ somewhat from the prevailing weather around them. These *microclimates* occur wherever a building, body of water, dense shrubs, or hillside modifies the larger climate.

Microclimates may be very small, such as the sunny side of your house or the shady side under a tree, or as large as a village. A town on the shore of Lake Michigan has a different microclimate than a town just 20 miles inland, for example. Common microclimates around your property may include the following:

- **North side of the house:** Cool and shady year-round
- **South side of the house:** Hot and sunny all day; often dry
- **East side of the house:** Warm morning sun and cool afternoon shade
- **West side of the house:** Morning shade and hot afternoon sun
- **Top of a hill:** Exposed to wind and sun; soil dries quickly
- **Bottom of a hill:** Collects cold air and may be poorly drained due to precipitation that runs down the slope

No doubt you can find other examples on your site as you closely observe the patterns of sun, water, wind, and temperature throughout the year.

TIP

Plan your landscape and gardens to take advantage of microclimates. Use wind-sheltered areas to protect tender plants from drying winter winds in cold climates and hot, dry winds in arid places. Put plants such as phlox and lilac, which are prone to leaf disease, in breezy garden spots as a natural way to prevent infections. Avoid putting frost-tender plants at the bottoms of hills, where pockets of cold air form.

REMEMBER

Urban environments typically experience higher temperatures than suburban or rural areas thanks to so many massive heat absorbers such as roofs, steel and glass buildings, concrete, billboards, and asphalt-paved surfaces. And that doesn't even begin to account for all the waste heat generated by human sources such as cars, air conditioners, and factories. The urban homesteader needs to consider all of these additional factors that could make their microclimate even more of a challenge.

Considering different sites

Choosing a site is the important first step in planning a vegetable garden. This may sound like a tough choice to make, but don't worry; a lot of the decision is based on good old common sense. When you're considering a site for your garden, remember these considerations:

- **Keep it close to home.** Plant your garden where you'll walk by it daily so that you remember to care for it. Also, a vegetable garden is a place people like to gather, so keep it close to a pathway.

  Vegetable gardens used to be relegated to some forlorn location out back. Unfortunately, if it's out of sight, it's out of mind. But most homesteaders prefer to plant vegetables front and center — even in the front yard. That way you get to see the fruits of your labor and remember what chores need to be done. Plus, it's a great way to engage the neighbors as they stroll by and admire your plants. You may even be inspired to share a tomato with them.

- **Make it easy to access.** If you need to bring in soil, compost, mulch, or wood by truck or car, make sure your garden can be easily reached by a vehicle. Otherwise you'll end up working way too hard to cart these essentials from one end of the yard to the other.
- **Have a water source close by.** Try to locate your garden as close as you can to an outdoor faucet. Hauling hundreds of feet of hose around the yard to water the garden will cause only more work and frustration. And, hey, isn't gardening supposed to be fun?

- **Keep it flat.** You can garden on a slight slope, and, in fact, a south-facing one is ideal since it warms up faster in spring. However, too severe a slope could lead to erosion problems. To avoid having to build terraces like those at Machu Picchu, plant your garden on flat ground.

REMEMBER

How big is too big for a veggie garden? If you're a first-time gardener, a size of 100 square feet is plenty of space to take care of. However, if you want to produce food for storing and sharing, a 20-foot-by-30-foot plot (600 square feet) is a great size. You can produce an abundance of different vegetables and still keep the plot looking good.

Speaking of upkeep, keep the following in mind when deciding how large to make your garden: If the soil is in good condition, a novice gardener can keep up with a 600-square-foot garden by devoting about a half-hour each day the first month of the season; in late spring through summer, a good half-hour of work every two to three days should keep the garden productive and looking good. Keep in mind that the smaller the garden, the less time it'll take to keep it looking great. Plus, after it's established, the garden will take less time to get up and running in the spring.

Letting the sun shine on your plot

REMEMBER

Vegetables need enough sun to produce at their best. Fruiting vegetables, such as tomatoes, peppers, beans, squash, melons, cucumbers, and eggplant, need at least six hours of direct sun a day for good yields. The amount of sun doesn't have to be continuous though. You can have three hours in the morning with some shade midday and then three more hours in the late afternoon.

However, if your little piece of heaven gets less than six hours of sun, don't give up. You have some options:

- Crops where you eat the leaves, such as lettuce, arugula, pac choi, and spinach, produce reasonably well in a partially shaded location where the sun shines directly on the plants for three to four hours a day.
- Root crops such as carrots, potatoes, and beets need more light than leafy vegetables, but they may do well getting only four to six hours of sun a day.

TIP

If you don't have enough sun to grow all the fruiting crops that you want, such as tomatoes and peppers, consider supplementing with a movable garden. Plant some crops in containers and move them to the sunniest spots in your yard throughout the year.

Keep in mind that sun and shade patterns change with the seasons. A site that's sunny in midsummer may later be shaded by trees, buildings, and the longer shadows of late fall and early spring. If you live in a mild-winter climate, such as parts of the southeastern and southwestern United States where it's possible to grow vegetables nearly year-round, choosing a spot that's sunny in winter as well as in summer is important. In general, sites that have clear southern exposure are sunniest in winter (refer to Figure 1-1).

You can have multiple vegetable garden plots around your yard matching the conditions with the vegetables you're growing. If your only sunny spot is a strip of ground along the front of the house, plant a row of peppers and tomatoes. If you have a perfect location near a backdoor, but it gets only morning sun, plant lettuce and greens in that plot.

If shade in your garden comes from nearby trees and shrubs, your vegetable plants will compete for water and nutrients as well as for light. Tree roots extend slightly beyond the *drip line,* the outer foliage reach of the tree. If possible, keep your garden out of the *root zones* (the areas that extend from the drip lines to the trunks) of surrounding trees and shrubs. If avoiding root zones isn't possible, give the vegetables more water and be sure to fertilize to compensate.

Checking your soil's drainage

After you've checked the site location and sun levels of your prospective garden, you need to focus on the third element of the big three: the soil. Ideally you have rich, loamy, well-drained soil with few. Unfortunately, that type of soil is a rarity. But a key that's even more essential to good soil is proper water drainage. Plant roots need air as well as water, and water-logged soils are low in air content. Puddles of water on the soil surface after a rain indicate poor drainage.

TIP

One way to check your soil's drainage is to dig a hole about 10 inches deep and fill it with water. Let the water drain and then fill the hole again the following day. Time how long it takes for the water to drain away. If water remains in the hole more than 8 to 10 hours after the second filling, your soil drainage needs improvement.

Soils made primarily of clay tend to be considered *heavy.* Heavy soils usually aren't as well drained as sandy soils. Adding lots of organic matter to your soil can improve soil drainage. Or you also can build raised beds on a poorly drained site.

But slow water drainage isn't always a bad thing. Soil also can be *too* well drained. Very sandy soil dries out quickly and needs frequent watering during dry spells. Again, adding lots of organic matter to sandy soil increases the amount of water it can hold.

If you encounter a lot of big rocks in your soil, you may want to look for another spot. Or consider going the raised-bed route. You can improve soils that have a lot of clay or that are too sandy, but very rocky soil can be a real headache. In fact, it can be impossible to garden in.

WARNING

Don't plant your garden near or on top of the leach lines of a septic system, for obvious reasons. And keep away from underground utilities. If you have questions, call your local utility company to locate underground lines. If you're unsure what's below ground, visit `www.call811.com` to have lines or pipes identified for free.

Deciding On a Layout

Designing a vegetable garden is a little bit of art and a little bit of science. Practically speaking, plants must be spaced properly so they have room to grow and arranged so taller vegetables don't shade lower-growing types. Different planting techniques fit the growth habits of different kinds of vegetables. You also should think about the paths between rows and plants. Will you have enough room to harvest, weed, and water, for example?

Your garden needs to make the most of the space you've got. Homesteaders tend to do some serious multitasking with every square foot of land they have to work with, but not everything can happen on the same patch of dirt. If your homesteading efforts will also include raising chickens, for example, you'll need to give your flock ample room for them to spread their wings, too.

A thoughtful garden layout is critical, even if it evolves (and it probably will) over time.

Looking at hills, rows, or raised beds

Before you sketch a plan, you need to decide how to arrange the plants in your garden. You can use three basic planting arrangements:

- **In rows:** Planting vegetables in rows is the typical farmer technique. Any vegetable can be planted in straight rows, but this arrangement works best with types that need quite a bit of room, such as tomatoes, beans, cabbages, corn, potatoes, peppers, and summer squash.

- **In hills:** Hills are typically used for vining crops such as cucumbers, melons, pumpkins, and winter squash. You can create a 1-foot-wide, flat-topped mound for heavy soil, or you can create a circle at ground level for sandy soil. You then surround the soil with a moatlike ring for watering. Two or three evenly spaced plants are grown on each hill. Space your hills the recommended distance used for rows of that vegetable.
- **In raised beds:** Raised beds are kind of like wide, flat-topped rows. They're usually at least 2 feet wide and raised at least 6 inches high, but any planting area that's raised above the surrounding ground level is a raised bed. Almost any vegetable can benefit from being grown on a raised bed, but smaller vegetables and root crops, such as lettuce, beets, carrots, onions, spinach, and radishes, really thrive with this type planting. On top of the raised bed you can grow plants in rows or with broadcast seeding.

  A raised bed can be *temporary*, with the soil piled 5 or 6 inches high. Or you can build a *permanent raised bed* with wood, stone, or masonry sides, as shown in Figure 1-3. And refer to Book 5, Chapter 1 for instructions on building your own easy raised garden beds.

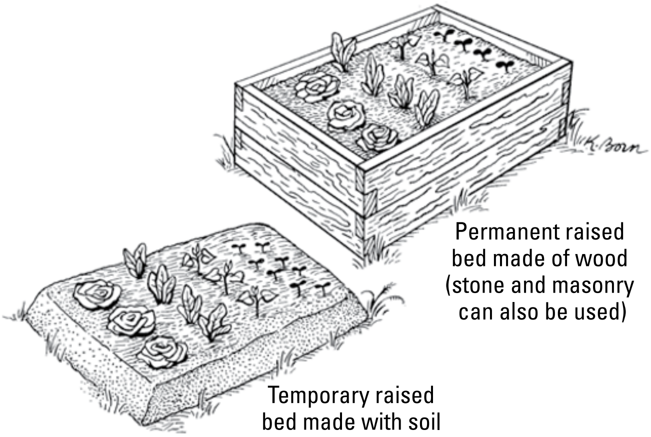

K. Born
Permanent raised bed made of wood (stone and masonry can also be used)
Temporary raised bed made with soil

FIGURE 1-3: Raised beds can be made with soil alone, or with wood, stone, or masonry sides.

Illustration by Kathryn Born

Raised beds have several advantages, including the following:

- **They rise above soil problems.** If you have bad soil or poor drainage, raised beds are for you. You can amend the garden soil in the raised bed with compost or the same sterile potting soil you use for containers. And because you don't step on the beds as you work, the soil is more likely to stay light and fluffy, providing the perfect conditions for root growth — especially for root crops such as carrots and beets.

- **They warm up quickly.** Because more of the soil in raised beds is exposed to the sun, the soil warms early and dries out faster, allowing for early planting and extended harvest seasons.

  WARNING

  If you're in a hot climate and have sandy soil, raised beds may not be for you, because they'll dry out and heat up too much.
- **They reduce your work.** By growing your vegetables in raised beds, you can maximize your fertilizing and watering so that more nutrients and water are actually used by the plants rather than wasted in the pathways.
- **They're easy on your back and knees.** If you design the beds properly (about 18 to 24 inches high and no wider than 4 feet), raised beds can make vegetable gardening a lot more comfortable. You can sit on the edge and easily reach into the bed to weed or harvest. You can even cap the edge to make it more benchlike.
- **They're attractive.** You can make raised beds in almost any shape you like — rectangle, square, triangle, circle. Just keep the width less than 4 feet so you can easily reach the center of the bed without stepping on the soil.

Never use pressure-treated wood or creosote-treated railroad ties to construct raised beds. These woods have been treated with chemicals, and although they'll last a long time, research has shown that some of these chemicals leach into the soil and can adversely affect your plants. The risk of poisoning your soil and crops is simply too great and far outweighs any benefits that might come with treated wood.

REMEMBER

The one possible downside of permanent raised beds is turning the soil. Lifting a tiller onto the bed can be difficult, so they may be best turned by hand with an iron fork or with a minitiller. There's more on tilling — including a gardening strategy that avoids it altogether — in Chapter 3 of this minibook.

In dry areas such as the desert Southwest, the traditional bed isn't raised — it's sunken. These *waffle beds* are created by digging into the soil about 6 inches deep and making a small wall of soil around the outside edge of the bed. This design allows the bed to catch any summer rains, protects young plants from the drying winds, and concentrates water where the vegetables grow.

Spacing your plantings properly

After you know what you're planting and how to arrange the plants, it's time to talk spacing. Make a list of the different types of vegetables that you want to grow, and then pay attention to these columns in the guide to planting in Chapter 4 of this minibook:

- **Plants/Seeds per 100 ft. of Row:** This column tells you how many plants/how much seed you need to purchase.
- **Spacing between Rows/Beds (Inches):** This column includes the ideal distance you should leave between rows or beds of different vegetables. This is usually a little more than the distance you should leave between plants.
- **Spacing between Plants (Inches):** In this column, you find the ideal distance to allow between individual vegetable plants within a row or planting bed.
- **Average Yield per 10 ft. of Row:** This column shows you how much you can expect to harvest.

TIP

If you're growing in raised beds, you can plant a little closer together than the guidelines suggest because you'll be concentrating fertilizer and water in a smaller space.

WARNING

Even though closer planting is possible, don't plant so close that plants have to compete with each other for food, water, and light. If you do, you'll eventually get smaller harvests or lower-quality vegetables.

Following the paths

You can get so involved in the beds, rows, hills, and vegetable varieties that you forget about the paths between everything. Keep the paths at least 2 to 3 feet wide so you can easily walk on them. For larger gardens, consider a few main paths that are wide enough for a garden cart.

Sketching it out

After you determine the location and dimensions of your garden, you need to sketch out a simple garden plan. A functional drawing is fine; it doesn't have to be a work of art. All you need is a piece of graph paper and a pencil, a list of vegetables you want to grow, and maybe a seed catalog or two. Then just grab your pencil and graph paper and start drawing. First, draw the garden to scale. Leave space from the edge of the paper, draw in the first row, leave room for a path, and then create your next row. Continue filling in the rows with your favorite crops, taking into account the space requirements of the crops you want to grow; whether you want to plant in rows, beds, or hills; and how much of each vegetable you want to harvest.

REMEMBER

Here are a few things to keep in mind as you sketch out your garden plan:

- **You can't plant everything.** Choose your crops carefully, and grow only what you like to eat. And grow only how much you think you can eat. Eating broccoli for breakfast, lunch, and dinner can get old fast.
- **Not all plants have it made in the shade.** Tall crops such as corn should be placed where they won't shade other vegetables. The north end of the garden is usually best.
- **These roots aren't made for walking.** Plan your garden with walkways so you can get to plants easily without damaging roots.

TIP

Planning on paper helps you purchase the correct number of seeds or transplants and use space more efficiently. It's a good way to see the possibilities for *succession planting* (following one crop with another) and *interplanting* (planting a quick maturing crop next to a slower-maturing one and harvesting the former before it competes for space). For example, you might see that you can follow your early peas with a crop of late broccoli, and you'll be ready with transplants in July. Or you might see that there's space to tuck a few lettuce plants among your tomatoes while the vines are still small. You can find out more about these techniques in Chapter 5 of this minibook.

Thinking Outside the Garden Bed

Not all of your crops have to be planted in the ground. Generations of resourceful gardeners and homesteaders have used various techniques to maximize their planting space well beyond the actual square footage of earth they have to work with. Keep them in mind as you plan your garden, and you may magically find room for a bunch more plants, a few more rows, maybe even a whole additional crop!

Going vertical

If you're short on space in your garden or want to plant more than you really have room for, go vertical! You can save space and energy by trellising, fencing, or caging certain vegetables. And by incorporating these vertical growers into your initial design, you can often free up more planting space in your beds. For example, one cucumber plant can take up 15 square feet or more when left sprawling on the ground. Grow your cukes on a trellis, and you can have four plants in that same amount of space.

Vertical gardening can create the additional space needed to help urban homesteaders grow a larger and more abundant vegetable garden, but the same techniques can help suburban gardeners and rural homesteaders maximize the output of a garden of any size!

Climbing vegetables, such as peas and pole beans, need fences or poles to grow on. These devices also save space. Set up a teepee of 6- to 8-foot poles, attach chicken wire to fence posts, or train the plants on an A-frame. (If you use the teepee method, wind some twine around the poles at 6-inch intervals to give the vines something to cling to or wind around.)

Cucumbers, melons, and even some squash love to vine and ramble. You can direct their energy by growing them on a trellis. Place the trellis on an angle, such as an A-frame design (shown in Figure 1-4), instead of straight up and down.

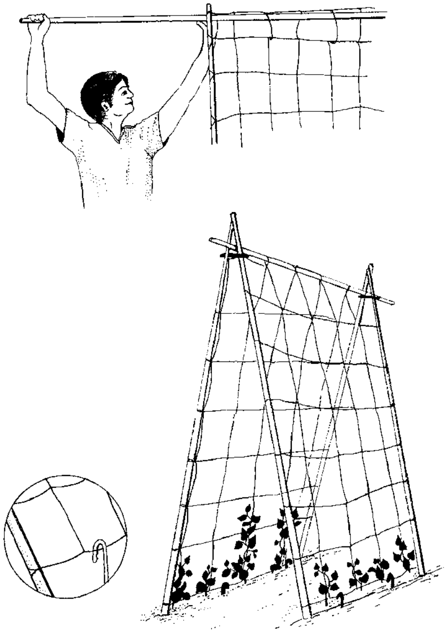


FIGURE 1-4: An A-frame.

REMEMBER

If you're growing vines with heavy fruits, such as melons or squash, make sure that the trellis is very sturdy. You can find step-by-step instructions for building your own trellises and such in Book 5, Chapter 1.

Tomatoes, peppers, and eggplants all can be caged or staked with a pole to keep them growing upright, elevate their fruits off the ground (which can help prevent disease and damage from slugs, mice, and other ground- dwelling critters), and give you more produce in less space. Commercial growers tie wire or twine between fence posts and weave the growing tomato plants through it. Also, 4- to 5-foot-high wire cages made of hog fencing or concrete reinforcing wire work well. Secure the cages with a tall stake pounded into the ground to prevent them from blowing over.

REMEMBER

Keep in mind that sun exposure is important for good vegetable production. Locate your trellises, teepees, or other vertical structure where the foliage will receive good sunlight without shading other areas of the garden.

Container vegetables

You can grow almost any vegetable in a container. Whether you're strapped for space in your beds, want to locate certain crops close to a patio or porch, or just want to add some architectural interest to your homestead landscape, containers offer all kinds of possibilities.

In most cases, pots that are bigger (in terms of width and volume) are better, especially for growing large plants such as tomatoes. Lots of root space means that your vegetables are less likely to get cramped; they'll also be easier to water and fertilize.

Pots made of porous materials such as clay dry out faster than those made of plastic or wood, so you must water the plants in them more frequently, especially in hot or windy climates.

REMEMBER

You're not limited to pricey ceramic pots from the garden superstore! Wooden window boxes, affordable plastic flowerpots, and hanging baskets offer alternatives. Of course, any kind of container at all can add a touch of creative whimsy with some plants growing in it: an old boot, a rusted-out galvanized bucket, a chicken feeder, a vintage wheelbarrow, or even an old bathtub can be turned into a planter by an imaginative gardener.

WARNING

All the pots you use for growing vegetables should have drainage holes; fortunately, almost all store-bought pots do. If you repurpose something else as a container, you may need to add a drainage hole so the plant roots don't drown.

REMEMBER

Don't fill your pot with soil from your garden — even if your garden has the very best soil on the planet. It's too heavy and too dirty (you know, weed seeds, bugs, bacteria — stuff that you don't want in your pots), and it may not drain properly in a pot. Instead, use potting soil.

Vegetable breeders have long had container gardeners in mind. They breed many small-space varieties (of even the most sprawling plants) that are ideal for growing in pots. The following list contains the most common vegetables to grow in containers, but try anything with the words *compact*, *bush*, *baby*, *midget*, *dwarf*, *tiny*, or *teeny* in the name:

- **Beans:** Bush varieties such as 'Provider' and 'Derby' are best; you can grow three to four plants in a 12-inch pot. You can grow pole types in a long narrow box, but you have to attach some type of trellis.
- **Beets:** Any variety grows well in a pot, and smaller varieties such as 'Red Ace 'even grow well in smaller pots. However, make sure your pot is big and deep enough (at least 12 inches); beets don't like to be crowded.
- **Carrots:** Carrots are a perfect vegetable to grow in a pot. Start with a baby variety such as 'Little Fingers', 'Short 'n Sweet', or T'humbelina'. If you water diligently, you can get a bumper harvest in pots as shallow as 6 to 8 inches deep. Longer varieties need deeper pots. After thinning, you should end up with 20 or so carrots per 12-inch pot.
- **Cole crops — broccoli, cabbage, cauliflower, and so on:** All the cole crops grow well in containers as long as your pots are big enough; try planting three or four plants in a half barrel.
- **Cucumbers:** You can't go wrong growing small cucumber types such as 'Bush Pickle' and 'Salad Bush'. Plant large-growing varieties in bigger pots and slip a sturdy wire cylinder into the outside edge of the pot for the plants to climb on.
- **Eggplant:** An eggplant's purple foliage and compact habit are perfect for pots; any variety works as long the container is at least 5 gallons. Plant one eggplant per 5-gallon pot. If a plant gets floppy, push a small stake in the pot to support the plant.
- **Lettuce and other greens:** Lettuce and greens may be the ultimate container vegetables. The size of your pot doesn't really matter — just sprinkle some seeds in it, keep the soil moist, and then get out your salad bowl for a great harvest. You can harvest the whole plant or snip off just what you need.
- **Melons:** Melons aren't ideal container subjects; they're wild and unruly. But through the magic of modern science, some dwarf varieties, such as 'Bush Sugar Baby' watermelon, grow well in containers. Plant one to two plants in a big pot (at least 5 gallons) and let the vines sprawl over the edges, supporting the fruit if necessary. And don't let up on water and fertilizer.
- **Onions:** Green onions — scallions or bunching onions if you prefer to call them that — grow well in containers. Just buy a bag of sets, plant them 2- to 3-inches deep, and you're in business. You can grow onions to full bulb size; just make sure that you use a big pot (preferably 5 gallons) and give them plenty of room to grow.

- **Peas:** Go with dwarf pea varieties such as 'Green Arrow' and 'Maestro', English peas, 'Sugar Bon' snap pea, or 'Dwarf Grey Sugar' snow pea. Any variety larger than that needs a trellis. Planting six plants in a 12-inch pot should be fine.
- **Peppers:** You can grow any pepper variety in a pot, but the bigger the pot the better. Small-fruited varieties such as 'Serrano' and 'Black Pearl' peppers produce so much colorful fruit that their containers become showpieces. A 5-gallon pot should hold one to two plants.
- **Potatoes:** Potatoes are fun vegetables to grow in a container. Just place 8 to 10 inches of potting soil in a big pot (at least a 5-gallon size). Plant two to three potato eyes 2 to 3 inches from the bottom of the pot, and then water them in. After the plants start to grow, cover the stems with more soil (leaving the very top exposed) until the pot is full. In a couple of months, you can harvest a pot full of spuds.
- **Radishes:** Growing radishes is quick and easy even in the smallest container. Scatter some seeds in the top of a pot, keep the soil moist, and you'll have radishes in less than a month.
- **Squash:** Use a 5-gallon pot (or even larger) to grow space-saving winter squash varieties such as 'Cornell Bush Delicata', 'Papaya Pear', or 'Table King'. Plant three seeds in each pot and thin to the healthiest plant.
- **Tomatoes:** Try your favorite dwarf indeterminate variety, such as 'Bush Big Boy' in a container that's at least 5 gallons (bigger is better), but be ready to stake or cage tall plants. Or you can grow dwarf varieties such as 'Patio', 'Tiny Tim', and 'Window Box Roma', which fit perfectly in pots, even smaller sizes.

Most herbs grow well in containers.

Vertical containers

After you wrap your head around the idea of growing things non-horizontally outside the garden bed, and warm up to the concept of growing some of your crops in containers, the next logical step is to take your containers vertical, too, and utilize all of that wall and fence space for growing.

Here is a list of some popular vertical gardening products:

- **Vertical containers:** Many interesting containers that are made for hanging on a fence, wall, or post are on the market now. Imagine a wall filled with flowering containers of cascading plants, or a monoculture of salad greens!

- **Pot hangers for containers:** Some garden centers now sell attractive pot hangers from which a terra-cotta pot can be hung on a post, wall, or fence. These hangers can be used to create a multitiered garden of radishes, chard, kohlrabi, lettuce, or other small greens. Other half-round containers are made for attaching to a wall or fence and make great use of limited space in city gardens.
- **Planter walls:** Manufacturers now include options for planting vertically along both freestanding and retaining walls. Another option to consider when building retaining walls is to divide the wall height and include a terraced area for planting between the walls (see Figure 1-5). For instance, instead of building an 8-foot-high wall, build two 4-foot-high walls with a 2-foot-wide planter between the two wall structures.

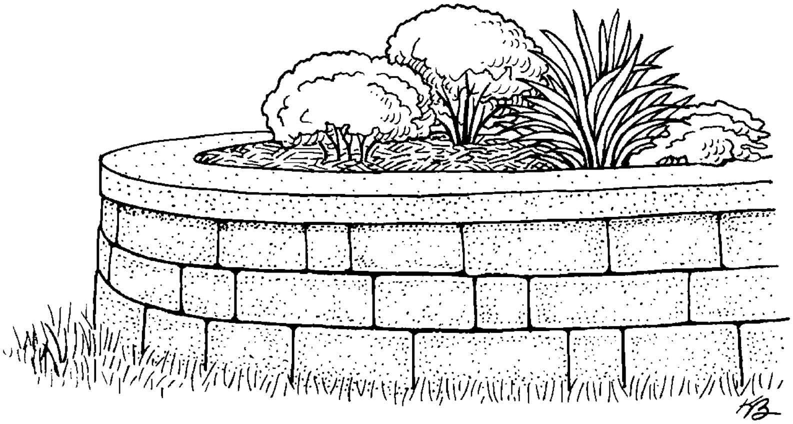


FIGURE 1-5: Example of a modular planter wall.

Illustration by Kathryn Born

- **Straddling containers:** Numerous products are available that (like a saddle) can straddle both sides of your balcony railing, even along the top of a fence. The Steckling plants container designed by German designer Michael Hilgers is one example of a modern design that has a look of a simple circular planter (see Figure 1-6, left), whereas more traditional balcony containers are boxier like window planters (see Figure 1-6, right).
- **Wall hanging pocket gardens:** Wall hanging pocket gardens (see Figure 1-7) are simple pocket planters which can easily hang and affix to walls, rails, and fences and can be used indoors or outside. They all come with simple

fasteners and anchors that work on masonry, drywall, sheetrock, wood, and metal walls.

- **Stacking planters:** Imagine picking the fruit from a stand of strawberries 3 feet high! Stacking planters are specifically designed so that when you stack them, they create a column of multiple and interconnected growing facets that may be suspended or just left freestanding. Nancy Jane's Stacking Planters are one product specifically designed so that when you stack them, they create a column of multiple and interconnected growing facets that may be suspended or just left freestanding. Check them out at `www.gardensupplyinc.com`.

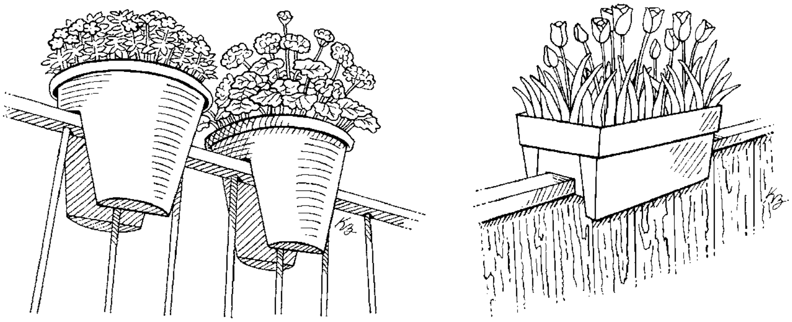


FIGURE 1-6: Different types of straddling containers.

Illustration by Kathryn Born

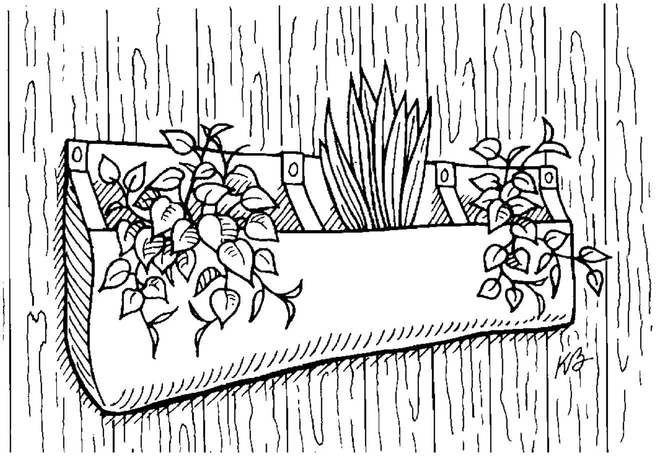


FIGURE 1-7: A wall hanging pocket garden.

Illustration by Kathryn Born

PALLET GARDENING: HOW DOES IT STACK UP?

Shipping pallets are being reused extensively in the garden today (see the figure), often being reconstructed into vertical garden features which are great for small or tight spaces. (You can remove and relocate some of the planks to form a series of tiered horizontal planter boxes along your pallet garden.) But many pallets are made with treated wood, and the chemicals used in that process may slowly leach into the soil over time. As cool as pallet gardens are, you shouldn't use them for vegetable gardens because the pallet wood may have been chemically treated, even if it might not look like it. Save the pallet garden for flowering annuals or other non-edibles only.

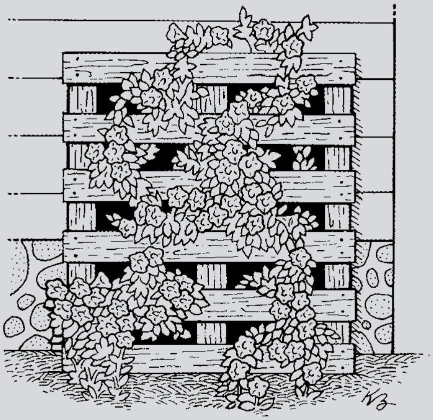


Illustration by Kathryn Born

Keeping Critters Out

A discussion of garden planning wouldn't be complete without considering the animals that may plague your gardens: deer, rabbits, groundhogs, and the like. Some of these larger critters can quickly eliminate an entire plant — or row of plants. Deer, rabbits, and woodchucks can consume a whole garden! The best way to deter these animals from helping themselves to your homestead is to figure out up front how you're going to keep them out, rather than wait until you already have a problem.

We'll deal with how to install various types of fencing in Chapter 3 of this minibook. Here, for your garden planning purposes, we'll limit ourselves to which members of the wild kingdom you need to be on the lookout for, and on guard against. (Animals are ordered from most to least damaging to a vegetable garden.)

Deer

Deer are among the most troublesome of garden pests. They live in wooded areas but also in suburban and urban locales, and in many places their numbers are increasing. When food is scarce, they eat just about anything. A deer or two can ravage an entire garden overnight.

To identify deer damage, look closely at affected plants. Deer don't have upper front teeth, so when they eat, they tear plant tissue rather than cutting it, leaving ragged edges. Deer prefer tender new growth when it's available, but eat buds and twigs in winter. They tend to feed on the edges of wooded areas so that they can duck for cover if threatened.

Deer can reach as high as 6 feet, so if you see damage at eye level, you're probably dealing with a deer, not a mutant rabbit. Look for telltale hoofprints and piles of deer scat (usually rounded pellets with a dimple on one end, about the size and shape of a chocolate-covered peanut or small black olive). Deer are most likely to visit gardens when other food sources are scarce, especially in late winter and early spring.

Fencing is the most common deer deterrent. But be prepared to think big (and potentially expensive). You might be surprised how high (and effortlessly) deer can jump. A 6-foot fence won't cut it; make it at least 8 feet high.

TIP

You can even make a 5-foot-fence more deerproof by using taller posts and attaching strands of wire above the fence, such as at 7 feet and 10 feet.

Consider slanting your fence outward, as shown in Figure 1-8. Deer are less likely to jump a wide fence, apparently intimidated about jumping when they can't tell how much distance they have to clear or how much space they'll have once they land. A slanted fence can be just 4 to 5 feet high and still be quite effective, but it does take up more yardspace.

Some gardeners rely on a double fence of sorts, with a 5- or 6-foot fence surrounding their garden, and a much shorter fence (or even a row of stakes with string run between them) just outside it. This visual barrier can confuse deer, who have poor depth perception, and encourage them to look elsewhere for their meal. Deer are creatures of habit; some gardeners find they can remove this outer barrier after the deer in their area change their travel pattern. If deer return, it's easy enough to reinstall the short outer fence.

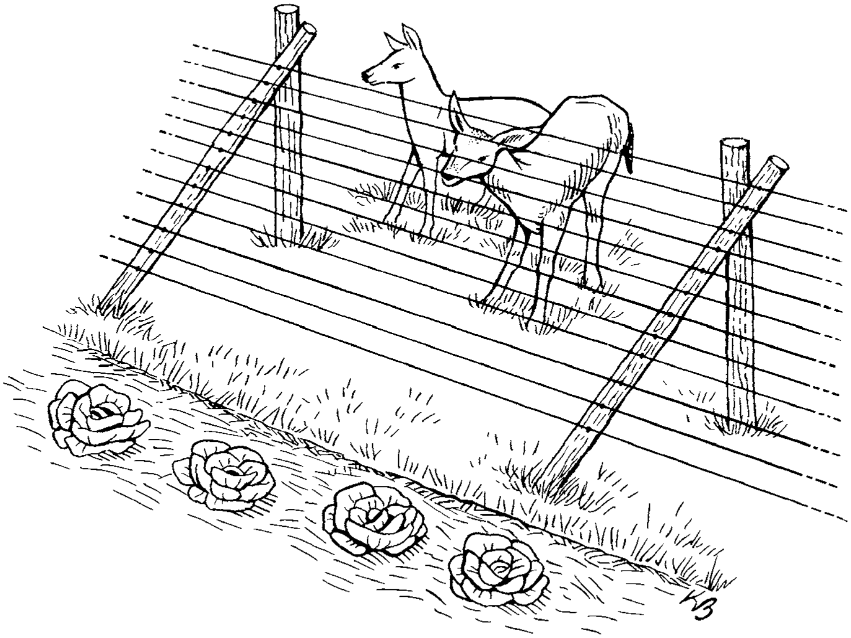


FIGURE 1-8: A slanted fence is the best design to keep deer out of your garden.

Illustration by Kathryn Born

Electric fencing or netting is the answer for other gardeners. Not intended to be a physical barrier, electric fencing uses a strong shock to convince deer that entering the garden is too painful to be worth the trouble. Some electric fences are solar powered, and some use scented bait to attract deer to the fence, where they touch an electrified strand and learn to avoid contact.

These are a few other tactics gardeners use to dissuade deer, from the ultra-practical to the super-weird.

- **Scare tactics:** Motion-detector-activated sprinklers may deter deer for a short time. (Just be sure to turn them off before you venture into the garden.) Playing a radio in the garden at night may work for a few days, but the deer will catch on quickly, and if they're hungry enough, they won't care.
- **Row covers:** In early spring, spread row-cover fabric over tender new growth, supporting the covers with wire cages or hoops if necessary. These row covers can deter the deer long enough to give your plants a head start and allow time for their natural wild food plants to become plentiful. Refer to Chapter 7 of this minibook for info on row covers.

- **Sprays:** Some gardeners swear by predator urine (which repels by scent) along with a bad-tasting hot pepper spray. But if you continually use the same deterrent, the deer will get used to it and ignore it.
- **Soap:** Hang bars of soap from low tree branches or from stakes so that the bars are about 30 inches off the ground. Fragrant, tallow-based soaps such as Irish Spring work best.
- **Hair:** Ask your barber or hairdresser if you can have some hair trimmings. Human hair hung in mesh bags about 3 feet off the ground may deter deer. Dog hair may work for some, too.
- **Homemade repellent:** Use spray repellents on foliage. One recipe: Mix three raw eggs in a gallon of water and spray the mixture on plants. This substance apparently smells worse to the deer than it does to you.

REMEMBER

Many plants are touted as deer resistant, but if deer are hungry enough, they'll eat just about anything. Still, if you live in an area where deer pressure is high, including plants such as catmint, hellebore, and yarrow increases the likelihood that at least something in your garden will survive.

Rabbits

Some homesteaders choose to raise rabbits (see Book 4, Chapter 3), but most prefer to keep Peter Cottontail and his friends away from their crops.

Rabbits are homebodies. They tend to stake out a rather small territory — 10 acres or less — and not wander elsewhere. They make their homes in natural cavities in trees, in other animals' abandoned burrows, in brush piles, and under buildings. They nibble the foliage of almost any plant, returning again and again, day and night, to finish the job.

Unlike deer, rabbits have both upper and lower front teeth, and you can identify their damage by a clean, angled cut on the ends of leaves and twigs. If you suspect rabbits, look for their droppings, which are round or slightly flattened; think marbles or M&Ms. The individual pellets are smaller and rounder than the more elongated deer scat.

Rabbits tend to eat vegetables and flowers in spring and summer. The best way to keep rabbits away from your plants is to fence them out. Because they burrow, a fence must also extend underground. Choose a 4-foot-high, chicken-wire fence with 1-inch mesh. Bury the bottom foot of the fence, bending the lowest 6 inches into a right angle facing outward.

Some folks have luck using hair gathered from hair salons and dog groomers as a repellent. Sprinkle it around the boundary of a garden and replenish it every few weeks. Most commercial spray repellents are not suitable for use on vegetables, as they affect the plants' taste, to both the rabbits and you.

Groundhogs

These slow-moving rodents, also called woodchucks and whistlepigs, live in an extensive system of underground dens and tunnels, and they defy you to find all their tunnel entrances. A tunnel can extend nearly 70 feet. If you see a mound of excavated earth surrounding a foot-wide hole, you're probably looking at the entrance to a groundhog tunnel.

Groundhogs generally stay within about 100 feet of their dens, venturing out morning and evening to find food: your tender veggies. They favor beans, squash, peas, and brassicas (the genus of plants that include broccoli, cabbage, and cauliflower) and they can mow down a row of seedlings overnight. They also gnaw and claw woody plants.

If you suspect groundhogs, scan your landscape in the morning and evening hours. They are relatively bold, and you may catch a culprit red-handed. Here are some deterrents:

- **Fencing:** Groundhogs can climb up almost as well as they can dig down, so use a sturdy 4- or 5-foot fence, and bury the bottom 18 inches underground. Bend the top of the fence outward so that a groundhog falls over backward if it attempts to climb over. Two strands of electric fence — one 4 inches above the ground and the other 8 inches high — may also keep them out.
- **Repellents:** Hot pepper wax sprays may act as deterrents; groundhogs don't seem to be fazed by other repellent sprays.

Gophers

These burrowing rodents live in underground tunnel systems extending as far as 200 yards. They feast underground on plant roots and bulbs, occasionally emerging to eat aboveground parts of those plants located near the tunnel openings. Most gopher species live in the western two thirds of the country; one species is native to the Southeast. (If you live in New England, don't blame your garden problems on gophers.)

The telltale sign of gophers is a collection of fan-shaped soil mounds, with new mounds appearing daily. You won't see a tunnel entrance; the critters keep the entrances plugged with soil.

Gophers are difficult to scare or repel. Castor oil sprayed on the garden may repel them. If gophers are a serious problem, you may want to go to the trouble of lining the sides and bottom of your garden at a depth of 2 feet with hardware cloth to keep the gophers out. (See Figure 1-9.) Gopher-resistant wire baskets, which can be placed in planting holes before planting, are commercially available. For persistent problems, use traps.

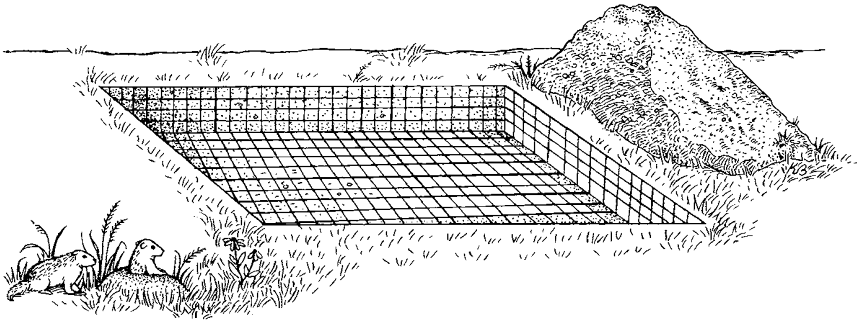


FIGURE 1-9: Buried fencing is the safest and most effective way to deter digging animals such as gophers.

Illustration by Kathryn Born

TIP

Research has shown that vibrating devices such as large whirligigs stuck in the ground near tunnels have little effect. Apparently, gophers in a home landscape even get used to the sounds and vibrations of mechanical equipment such as lawn mowers. So don't waste your money on these devices.

Mice and voles

Mice and voles look similar. Both are small rodents, but the tail of a vole is much shorter than that of a mouse. Mice are fond of young seedlings, especially those growing in a greenhouse on a cold winter day; they're omnivores, though, and eat almost anything. (They can be particularly problematic for backyard chickenkeepers, as we discuss in Book 4, Chapter 4.) Voles, on the other hand, are almost exclusively herbivores and are the more troublesome pest for gardeners.

Voles create extensive networks of tunnels that, if located under your garden or lawn, can cause root damage. Chewed root vegetables probably are the work of voles. Look for the tiny, 1⁄8-inch-wide chisel marks left by their incisors. Damage to stored vegetables, on the other hand, probably is the work of mice.

Voles are hard to control, but you can discourage them by keeping grass mowed and your yard free of weeds. (More on why and how to control weeds in Chapter 5 of this minibook.) Surround valuable plantings with a fence made of 1⁄4-inch hardware cloth buried 6 inches deep and rising at least a foot off the ground. Keep the perimeter mowed and free of plant debris.

Raccoons

Raccoons like to eat pretty much anything. They seem to appear out of nowhere to pilfer your fruit and corn just before you get out to harvest it. They also eat grubs and, like skunks, dig up your lawn to find them, damaging plants in the process.

Repellents and motion-detector-activated sprinklers may provide enough protection to allow your crops to ripen. Controlling grubs in the lawn can also help. A low, two-strand electric fence, described in the "Groundhogs" section, might keep raccoons out of your vegetable garden.

You might also consider a 5-foot wire-mesh fence specially modified to use the raccoon's body weight against it. Bury the bottom 12 inches of fence, curving the material away from the garden, allowing 4 feet of fence to stand aboveground. But leave the top 18 inches unattached to support posts; if a raccoon attempts to climb the fence, it will bend back down under the animal's weight.

Squirrels

Squirrels are so bold, it's likely that you'll catch them in the act of digging in your garden. These agile, fearless creatures can cause quite a problem, eating fruits, nuts, berries, seedlings, and bark. . . even pilfering softball-sized tomatoes!

You can't get rid of squirrels permanently. If you evict your current residents, new ones will come to take their place. You can try deterrents such as spraying bad-tasting sprays on favorite plants, however.

For some crops, you can cover newly planted beds with chicken wire; the plants will grow right through it in spring. Motion detector–activated sprinklers can offer short-term help.

WARNING

Despite advice you may have heard, don't use mothballs in the garden as a squirrel deterrent. You don't want this potential carcinogen contaminating your soil.

Birds

Birds in the yard are a mixed blessing. You appreciate their appetite for insects, but when they nibble on the tomatoes and devour the ripe blueberries, they cross the line into nuisance territory. You can keep birds away from your plants by draping bird netting or row covers over them, but this solution isn't always practical.

To keep birds from eating seeds or pulling up newly sprouted plants, protect your seedbed with a bird tunnel (see Figure 1-10) or a floating row cover. By the time the plants outgrow the cover, they're no longer appetizing to birds.

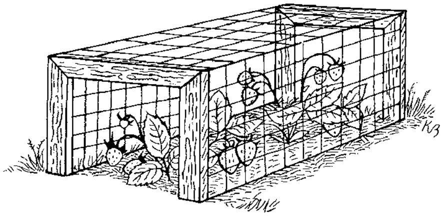


FIGURE 1-10: Covering seedlings with a portable bird tunnel is a sure way to keep birds away.

Illustration by Kathryn Born

Noise, fluttering objects, and anything resembling a predator can startle birds. Try bordering your garden with strings tied to stakes and fastening aluminum pie plates or unwanted CDs to the string. The noise and flashing of the sun on the shiny surfaces can scare birds away. Or instead of string, use only a thin nylon line, which will vibrate and hum in the breeze.

Flash, or *scare, tape* is effective. Available in long rolls, this lightweight iridescent ribbon is cut to size and can be hung anywhere birds are a nuisance. The streamers flutter in even a slight breeze, scaring away birds with both noise and bright reflected light.

You can use the modern version of the scarecrow: balloons and kites with images of predators, such as owls and hawks. Place them in the garden to convince birds that their enemy is on guard.

TIP

Birds catch on quickly, so change your scare tactics regularly.

Assembling Tools

You've probably heard this saying at least a hundred times: "Use the right tool for the job."

When planning a new vegetable garden, however, you may find that knowing which tools to pick is often confusing. You can spend hundreds of dollars buying tools for every imaginable use, but you may end up spending more time in your tool shed than in your garden. So when you're selecting your tools, it's best to start simple — here are the ten essential tools. And keep in mind that even these tools may not be appropriate for all garden situations.

TIP

To keep your metal hand tools functioning for years, clean and store them properly. After you're finished using a tool, wash all soil off it. Yearly, sharpen the blades of weeders, spades, and shovels; oil wooden handles with linseed oil; and tighten any nuts and screws on the handles.

Watering hoses and cans

Even if you have a fully-operational irrigation system (you'll find options in Chapter 3 of this minibook), there will be times when it's best to water by hand with a good old-fashioned hose and watering can. (One of these times is when caring for seedlings and new plants, as discussed in Chapter 4 of this minibook.)

Rubber hoses are less likely to kink than vinyl or nylon hoses, but they tend to be much heavier to move around. Whatever material you choose, be sure to get a hose that's long enough to reach plants in all areas of your garden without having to shoot water across the beds to reach distant plants. Choose a hose that has brass fittings and a washer integrated into the hose; these elements make the hose less likely to fail after prolonged use.

Watering cans can be made of simple, inexpensive, brightly colored plastic or high-end, fancy galvanized metal. Plastic is lighter, but galvanized metal is rustproof and more attractive. Watering cans also come in different sizes, so try a few out for comfort before buying. Make sure you can easily remove the sprinkler head, or rose, for cleaning.

TIP

For watering tender seedlings, buy a can with an oval rose that points upward and applies water with less pressure. The traditional round rose is better for watering more mature plants.

Hand trowels

Hand trowels are essential for digging in containers, window boxes, and small raised beds. The wider-bladed hand trowels, which are scoop shaped and rounded on the end, are easier to use to loosen soil than the narrower-bladed, V-pointed ones. These narrower blades are better for digging tough weeds, such as dandelions.

Hand trowel blades usually are made of steel or plastic. Steel blades are more durable, but plastic blades are lighter. Although stainless steel versions are more expensive than plastic ones, they're easier to clean and easier to find if you lose them. The handles may be steel, wooden, or plastic. Choose a trowel that's forged as one piece of metal or that has secure attachments between the blade and handle.

Try different hand trowels before buying, choosing one that feels comfortable and that fits your hand well. Ergonomic versions of hand trowels have forearm supports and cushioned grips.

Hand cultivators

A *three-pronged hand cultivator* is a handy tool to break up soil clods, smooth seed beds, and work in granular fertilizer. Plus, after you plant your small container or raised bed, the weeds will come whether you like it or not; a cultivator serves as a great tool to remove these young weeds as they germinate. When you're digging a planting hole, a hand cultivator breaks up the soil more easily than a hand trowel.

As with a hand trowel, be sure to choose a hand cultivator that feels comfortable in your hand and that has a handle securely fastened to the blade. The steel-bladed types are the most durable.

Garden hoes

Hoes are available for all occasions — hoes for digging furrows, hoes for weeding, hoes for wide rows, hoes for tight rows, hoes that scuffle, hoes that oscillate, and even hoes for specific vegetables such as the onion hoe. What you need largely depends on the design of your garden. The best hoes have long hardwood handles and single-forged steel blades strongly attached to their handles. Here are three favorites:

- **Common garden hoe:** This classic hoe has a broad, straight, 6-inch steel blade that's good for all types of gardening, including digging, weeding, chopping, hilling, and cultivating. Longer- and narrower-bladed versions, such as the collinear hoe, are good for weeding in tight spots.
- **Oscillating hoe (also known as a stirrup hoe):** This hoe, shown in Figure 1-11, is primarily used for weeding. Unlike other hoes — which cut weeds on the pull stroke — this hoe cuts weeds on the pull stroke *and* the push stroke, enabling you to weed faster. The 4- to 7-inch-wide steel stirrup is hinged so it moves back and forth, digging about 1⁄4 inch deep into the soil and scalping off young weeds. This hoe works well in gardens with clearly defined rows and spaces between plants.
- **Tined hoe:** This hoe has 3 or 4 steel tines attached to the bottom of a 5- to 6-inch-diameter steel head. Tined hoes are good for weeding, cultivating, digging, chopping, hilling, and breaking up soil clods. They're lighter, more versatile, and easier to use than common hoes.

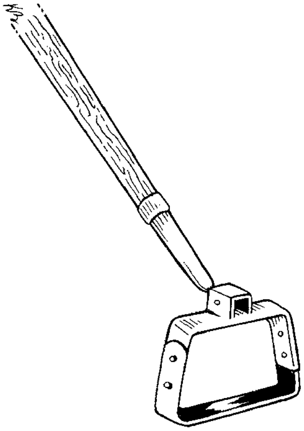


FIGURE 1-11: An oscillating hoe.

Spades and shovels

Spades and shovels are two of the most commonly used gardening tools. The difference between the two is simple: A *spade* is designed for digging, and a *shovel* is designed for scooping and throwing. Shovels traditionally have rounded and pointed blades, whereas spades have flat, straight, almost rectangular blades. A good shovel is essential in any garden for spreading compost, manure, or fertilizer. A spade is essential for edging or breaking new ground. However, many gardeners use spades for anything from cutting open fertilizer bags to hammering in stakes. Good spades are rugged.

Both spades and shovels come in short- and long-handled versions. A long handle gives you more leverage when digging holes, so keep that in mind if you're purchasing a new spade. Choose a spade or a shovel that has a single piece of metal attached to a wooden handle with either a single socket or a single socket that runs 1 foot up the handle (referred to as a *solid-strap* connection). These models are heavier, but they're much more durable.

TIP

To get a more comfortable grip on long-handled tools such as spades and shovels, try low-cost foam grippers that fit on the handles. These grippers make the diameter of a handle larger and more cushioned, reducing the amount of blistering and cramping in your hands. They're available at local garden centers or on the Internet.

Garden forks

As handy as a spade is for turning fresh garden soil, an *iron fork* (also called a garden fork, a spading fork, a digging fork, or even a border fork) is a better tool for turning beds that have been worked before. The fork digs into the soil as deep as

12 inches, and at the same time breaks up clods and loosens and aerates the soil better than a spade. Iron forks look similar to short-handled spades except that they have three to four iron tines on their heads. The best ones are those forged from one piece of steel with hardwood handles firmly attached. They're great not only for turning soil but also for turning compost piles and digging root crops, such as potatoes and carrots.

One tool you may want to consider is the *broadfork*. With two long handles and a series of deep curved tines between them (see Figure 1-12), the gardener steps onto the crossbar of the broadfork (sometimes called a U-fork or *grelinette*), using body weight to till and break up garden beds without destroying the soil's structure.

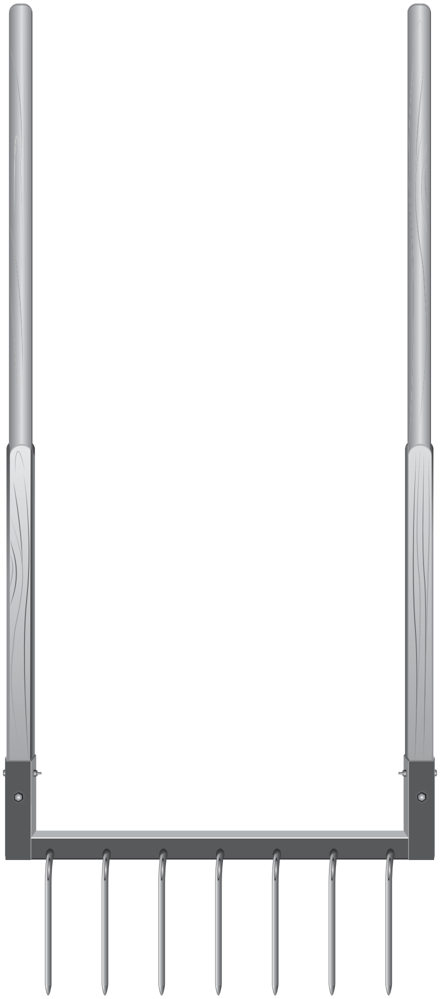


FIGURE 1-12: A broadfork uses body weight to efficiently break up garden soil.

TIP

A heavy-duty broadfork can be quite expensive; many gardeners get by with a conventional pitchfork. Some even roll up their sleeves (and ingenuity) to make their own broadfork!

Garden rakes

After you dig soil, you need to level it, break up soil clods, and smooth the seedbeds (especially if you're growing raised beds). An *iron rake* is the right tool for the job even though you may use it for this purpose only a few times a year. A 14-inch-diameter, iron-toothed rake should have a long, wooden handle that's securely attached to a metal head. You can flip the metal head over to really smooth a seedbed flat. For a lightweight but less durable version of an iron rake, try an aluminum rake.

Buckets, wagons, and baskets

You may not have a 1,000-square-foot garden. But you still need to carry seeds, tools, fertilizer, produce, and other items around. Here are three essential containers:

- **Buckets:** For fertilizers, potting soil, and hand tools, a 5-gallon plastic bucket is the perfect container. You can probably get one free from a construction site; just make sure to clean it out well. For a more durable but smaller bucket, buy one made from galvanized steel.
- **Wagons:** For bulkier items, such as flats of seedlings, use a child's old red wagon. Wagons are great for moving plants and small bags of fertilizer in your garden, and the lip on the wagon bed helps hold these items in place when you cover bumpy ground. If you're interested in a wagon to move yourself (and not just equipment) around the garden, try a wagon with a seat. This type of wagon usually has a swiveling seat and is perched on four pneumatic tires, allowing you to sit and push yourself through the garden as you work (see Figure 1-13). It has storage space under the seat as well.
- **Baskets:** To gather all that great produce you grow and harvest, invest in a wire or wicker basket. Wire baskets are easier to use because you can wash the produce while it's still in the basket. Wicker and wooden baskets, though less durable than metal, are more aesthetically pleasing and stylish in your garden. Piling your produce in either basket is a lot more functional than trying to balance zucchinis in your arms while carrying them from your garden to your kitchen.

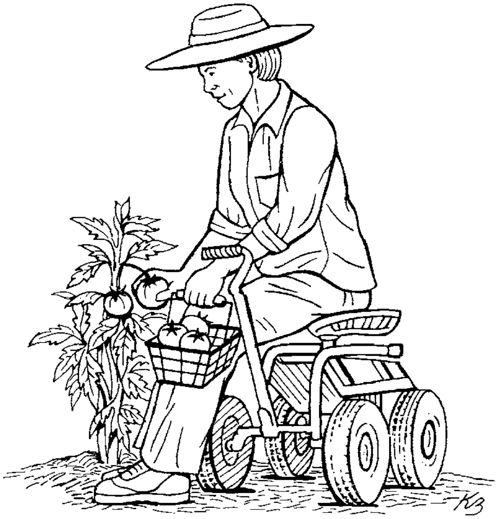


FIGURE 1-13: A wagon with a seat and storage space is useful in the garden.

Illustration by Kathryn Born

Wheelbarrows and garden carts

Invariably you need to move heavy items such as soil and fertilizer from one spot to another in your yard or garden. The two main options for moving stuff that's "larger than a bread box" are wheelbarrows and garden carts. The basic difference between the two vehicles is the wheels. *Wheelbarrows* have one or two wheels and an oval tray; *garden carts* have two wheels and a boxy rectangular wooden tray.

Wheelbarrows are maneuverable in tight places, can turn on a dime, and are easy to dump. A contractor-type wheelbarrow has a deeper box and is worth the extra investment because of its superior quality. For a lightweight wheelbarrow, try one with a box made out of plastic.

Garden carts are better balanced, can carry larger loads, and are easier to push than wheelbarrows. A larger-sized garden cart can easily handle loads of compost, soil, rocks, and bales of hay. Some garden carts even have removable back panels that make dumping easier.

Power tillers

The old-fashioned rear- or front-tined *power tiller* was designed to help large-scale gardeners save time breaking ground in their gardens. The large power tillers (more than a 5-horsepower engine) are best if you have 1,000 square feet or more to till. They also can be indispensable tools for forming raised beds and breaking sod.

TIP

If you need to use a large tiller only once a year, consider renting one from a local rental store.

Because home gardens have become smaller, tiller manufacturers have responded by designing a new group of tillers called *minitillers* (see Figure 1-14). These two-cycle, 1- to 2-horsepower tillers weigh only 20 to 30 pounds, are easy to handle, and can till in tight places. They not only have tilling tines but also come with other attachments such as lawn aerators, edgers, and lawn dethatchers.

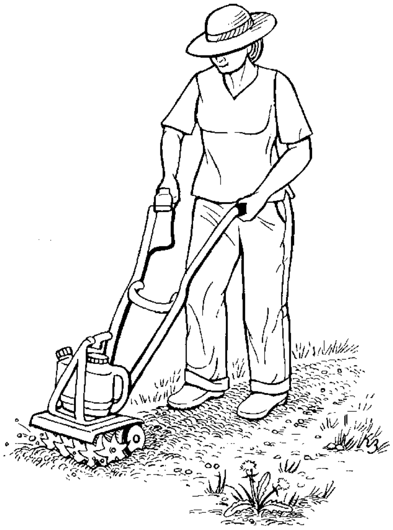


FIGURE 1-14: A minitiller is perfect for smaller home gardens.

Illustration by Kathryn Born

Minitillers work best in previously worked, loamy soil without large stones. Unlike their larger cousins, minitillers are easy to handle when you're weeding between rows of vegetables and close to plants. However, they aren't good for breaking new ground or tilling stony or heavily weeded areas in your garden. Because they're lightweight, they till raised beds and small gardens very well. Electric models are available if you don't like the noise and smell of a two-cycle engine.

IN THIS CHAPTER

- **Selecting crops that best suit your growing conditions**
- **Choosing vegetable, fruit, and herb varieties with success**

Chapter 2

Deciding What to Grow

Few things are better than fresh fruits and vegetables, and growing your own can be very rewarding. You may want to grow just enough for yourself, or you may decide to grow extra so you can pocket a little cash. And if you have animals, you may want to raise crops to feed them.

As you plan your garden, you need to consider how much of your day you want to devote to caring for crops, how long you want the growing season to last, which types of crops you want to grow, what kind of soil you have, and how to supplement the soil so it makes for a perfect environment. This chapter helps you answer some of those questions and describes common fruits and vegetables and how best to grow them.

Understanding Veggie Varieties

Before you go drooling over the luscious veggies in catalogs, in garden centers, and online, it's good to know a little about the varieties you can choose from. If you select your veggie varieties before you design your garden (as laid out in Chapter 1 of this minibook), you can ensure that you have the proper amount of space and the best growing conditions.

A *variety* is a selection of a particular type of vegetable that has certain predictable, desirable traits. These traits may include the following:

- **Adaptation:** Some varieties are particularly well adapted to certain areas and climates. For example, some tomato varieties produce good-tasting fruit in the cool, foggy coastal climates of the Pacific Northwest. And certain bean varieties are better adapted to the hot, dry deserts of the American southwest.
- **Appearance:** You can choose from a rainbow of fruit and leaf colors, such as purple peppers, yellow chard, and orange tomatoes. Leaf textures and shapes range from frilly to smooth to puckered. The flowers of some vegetables, such as okra and eggplant, are attractive in their own right. You get the idea. The more beautiful the vegetables, the more beautiful the vegetable garden — and the more stunning the food.
- **Cooking and storage characteristics:** Certain varieties of beans and peas, for example, freeze better than others. Some winter squash varieties may be stored for months, but others need to be eaten immediately.
- **Days to maturity (or days to harvest):** Days to maturity refers to the number of days it takes (under normal conditions) for a vegetable planted from seed (or from transplants) to mature and produce a crop. This number is especially important for vegetable gardeners who live in short-summer climates. Average days to maturity are listed for each type of vegetable in Chapter 4 of this minibook.
- **Extended harvest season:** A certain variety of corn, for example, may ripen early or late in the season. By planting varieties that ripen at different times, you can start harvesting as early as 60 days after seeding and continue for five or six weeks. Seed catalogs and packages often describe varieties as early season, midseason, or late season in relationship to other varieties of the same vegetable.
- **Pest resistance:** Many vegetable varieties are resistant to specific diseases or pests — a very important trait in many areas. Some tomato varieties, in particular, have outstanding disease resistance. See Chapter 6 of this minibook for more on pest control.
- **Plant size:** The trend in vegetable breeding is to go small. Tomato, cucumber, and even winter squash varieties are available in dwarf sizes. These varieties are perfect for container growing or small-space gardens.
- **Taste:** Choose a flavor and you can find a vegetable that stars in it. You can grow fruity tomatoes, super-sweet varieties of corn, bitter melons, and spicy peppers. You'll discover flavors for every taste bud.

REMEMBER

To realize the scope of your vegetable variety possibilities, it's important to note that you can categorize a variety as a hybrid, an open-pollinated, or an heirloom variety. Here's what these terms mean:

- **Hybrid:** Hybrid seeds (also known as F-1 hybrids) are the result of a cross of selected groups of plants of the same kind, called inbred lines. (A cross is when pollen from one flower fertilizes a flower from another similar plant, resulting in seed.) Hybrid seeds generally are more expensive than open-pollinated seeds, and they can't be saved and planted the next year because the offspring won't have the same characteristics as the parents. If you did plant them next year, you'd get a mix of characteristics — some desirable and some not. The plants are uniform, but they often lack a diversity of shapes, colors, sizes, and flavors. However, hybrid plants are more vigorous, productive, and widely adapted than other varieties.
- **Open-pollinated:** Open-pollinated varieties basically are inbred lines allowed to pollinate each other in open fields. They produce offspring that are similar to their parents. Before the arrival of hybrids, all vegetable varieties were open-pollinated. Some gardeners like these varieties for their flavor, their diversity, and the fact that they can save the seeds each year to replant. The resulting offspring are pretty predictable, but they don't provide the consistency of hybrids.
- **Heirloom:** Any open-pollinated variety that's at least 50 years old is generally considered an heirloom. Heirlooms are enjoying quite a revival because of the variety of colors, tastes, and forms that are available. They're worth trying, but keep in mind that some varieties may not have the disease resistance and wide adaptability that hybrids generally have.

Deciding How Much to Grow

Just because you have a bit of land for growing veggies doesn't necessarily mean you're interested in taking on the task of planting, tending, and harvesting crops on the whole plot. That's a lot of work for a homesteader! But maybe you do want to do it. Maybe you have dreams of raising enough to sell to the local grocery stores and farmer's markets and of lining your pockets with some extra cash. Or maybe you have dreams of becoming a full-fledged, full-time farmer, and you need to get your feet wet on a smaller scale before taking the giant plunge.

Before you plant your first seed or seedling, you need to determine how much to grow to suit your purposes, and think about the time you have available for managing your crop or garden. You may be surprised at how much you can grow in a small space. Sometimes, the smaller the space, the more attention you can give, and thus the more yield you get.

Supplementing your grocery needs and sharing with friends

Have you ever added up how much you spend on fruits and veggies per year? Wouldn't it be cool if you could reduce or even eliminate that expenditure? Well, with a little bit of acreage, a little knowledge, and a little work, that's very possible.

As far as the amount of space you need, you may hear all kinds of suggestions. One source says with 500 square feet, you can grow 90 percent of a person's annual vegetable requirements; however, your results will undoubtedly vary.

If your intention is not only to feed yourself but also to treat your relatives, friends, neighbors, and coworkers, you need a few more plants. Or you may just be content to share any overabundance that grows from what you've planned for yourself. Many plants produce all their fruit within the span of a few weeks, so if your freezer is getting just a little too full of grated zucchini, share the wealth!

To determine how much you'll need, ask yourself how much your family consumes: How big is your family? Do the little ones even like vegetables? A couple of tomato plants may be sufficient for a family of two who mostly uses tomatoes as a garnish or maybe as an accent in sandwiches, but for a family who loves and eats salads at every dinner, you want to go with several plants. Chat with neighbors, the county extension agent, and the people at the seed stores for advice. You'll most likely go through a few seasons of trial and error before getting the garden size right.

Selling at the market

If you have enough land and time, planting a lot more, with the intention of selling to local markets — or setting up a table at the various farmer's markets that crop up in the summertime — can very well give you some well-deserved pocket money, as well as a little fun socializing with the people who come to visit. To get an idea of just how much you should plant, ask neighbors for suggestions, inquire at your local cooperative extension office, or even chat with farmers at the farmer's markets (which can give you planting ideas for next year).

WARNING

A lot of rules and regulations come with selling food to the general public, and each state defines its requirements. If you operate as a produce stand — you handle only raw, unprocessed fruits and vegetables as opposed to selling prepared food — you may get away with anything from very limited rules to having a food handler's certificate or specific equipment (such as refrigeration) at your booth.

Going all the way to a subsistence-level operation

Being completely self-sufficient — growing enough to meet your basic needs — requires a bit more work. You have to be diligent about caring for the plants, dealing with pests, and so on, and you'll be spending more of your time out in the field than inside enjoying a warm fire or a cold beer.

Although being able to fend for yourself may seem like a romantic concept, you may want to read about some of the hardships American pioneers and homesteaders faced. And no, I don't mean using buffalo chips for fuel, repairing broken wagon wheels, building houses out of sod, and using oxen-drawn plows, because in this day and age, most of those problems are a thing of the past. But you may still face droughts or insect infestations that may mean little or no food one year. Of course, today, you'll always have a backup in place (a grocery store nearby) to run to if your crops fail.

For a subsistence-level operation, you freeze, dry, or can fruits and veggies to preserve them for the off-season. The freezer is definitely an advantage you have over the homesteaders. Instead of having to dry veggies or smoke meats, you can simply toss things in the freezer and have at them as needed, well outside the growing season. (See Book 2 for more about enjoying the fruits of your labor.)

REMEMBER

You'll probably have to do a few seasons of trial and error until you find out just how much you need to plant. That means estimating what your family consumes in a year and planting what you think will cover that, adding a little extra as a buffer in case some of the plants fail. You may even consider growing a bit more than you'll consume so you can harvest the seeds, dry them, and use them the next season. Then see where you stand at the end of the winter when it's time to start the growing all over again. If you find that you misestimated, adjust accordingly.

Even with all this calculation, you may not be able to be completely self-sufficient. You may get the plants right, but if you want to eat meat, you may need to find a good butcher. Or perhaps you want to do some bartering for something your neighbor grows, exchanging some corn for some okra. Or how about trading some tomatoes for some fresh goat's milk?

Succeeding with Vegetables

With so many options for veggies to pour your time, money, and heart into, the possibilities may seem endless. Some limitations that can help you make your decision are the amount of space you actually have to devote to crops, the quality of your soil, and the growing season, although certain varieties may be able to compensate for those shortcomings. The ultimate decision may come down to what you like to eat.

Although what grows well may vary according to your soil and your skills, this section lists veggies that homesteaders typically grow pretty well. Whatever you plant, and however many you decide on, you should probably plant at least two plants so that if something doesn't mesh with one, you have a backup plant. Some plants even require partners so they can pollinate each other.

Because your livelihood doesn't depend on having a successful crop, feel free to experiment with what and how much you plant. As you become more confident about both what grows well in your area and how much time and effort you can afford to invest, you can expand or contract your garden as needed.

Cucumbers, melons, and squashes

Cucumbers, melons, and squashes are all members of the cucumber family. They all have in common their love of heat, their capability to grow long stems (and vine to great lengths), and the fact that they have separate male and female flowers on the same plant. These viners need someone to play Cupid and bring pollen from the male flower to the female flower to produce fruit. If you're trying out beekeeping, as explored in Book 4, Chapters 1 and 2, they'll handle this job happily.

This large family of vegetables is known for producing lots of fruits and taking up lots of room in the process. However, modern plant breeders have responded to the need for smaller, space-saving vegetable plants by breeding bush (nonvining) varieties of some favorite cucumber-family crops.

Cucumbers

Cucumber varieties usually are categorized two ways: slicers and picklers. Slicing-cucumber varieties are long, smooth-skinned cucumbers that tend to be larger, a darker shade of green, and have thicker skin with fewer bumps (spines) than pickling varieties, which are short and prickly. Slicing cucumbers are the ones you're probably most familiar with from grocery stores; they're great in salads and other recipes, but they're also super for munching. You can use pickling varieties the same ways you use slicing varieties, and they're great when eaten fresh. But if you want to make pickles, the pickling varieties have better textures for it than the slicers.

The easiest cucumber varieties to grow are the hybrid bush types. These varieties, such as 'Salad Bush', are good producers, are disease resistant, and produce a small vining plant that can grow in a container. Bush types don't produce as many cucumbers as larger vining varieties, nor do they produce them all summer long. But if you have a small family, a few bush varieties should be plenty.

TIP

You'll see some cucumber varieties labeled as *burpless.* This thin-skinned cucumber type has a long, slender shape and a mild flavor that isn't bitter. It's said to produce less intestinal gas than other varieties, which clearly explains where it got its name.

Melons

Most gardeners are familiar with the two most popular types of melons: muskmelons (also known as cantaloupes) and watermelons. But more and more exotic melon types continue to show up in produce markets and seed catalogs. These exotic types include crenshaw, honeydew, and charentais. They're similar to muskmelons, but they offer a tropical, juicy flavor.

Watermelons come in the traditional "let's have a picnic" oblong shape as well as the more compact, round shape (also called an icebox shape). Yellow-fleshed and seedless watermelon varieties also are available. Most muskmelons tend to weigh between 2 and 5 pounds, but watermelons can run from 8 pounds to between 20 and 30 pounds.

WARNING

Seedless watermelon varieties may germinate more slowly than other varieties, especially in cool soils (below 65 degrees Fahrenheit). So wait until the soil is warm before seeding and give them a few more days than the other watermelon varieties to germinate.

Summer squash

Although many varieties of squash are available, a couple consistently show up in gardens because of their ease of growing and their tastiness and familiarity to the consumer. Squashes come in two basic varieties: summer and winter. Summer squashes are those with a soft skin that you pick and eat all summer.

Summer squashes thrive in warm weather and have a soft, pliable shell. Of the several varieties that abound in the summer squash class, the most popular is the zucchini. It's a prolific plant, and its fruit is versatile — you can eat it raw in salads, steam or grill it as a side dish, or even use it as an ingredient in a sweet, cinnamony bread!

Unless you really like zucchini, or unless you plan to sell the things and have a reliable recipient, don't plant more than a few plants. They'll yield dozens of veggies throughout a season. Their mission in life is to produce offspring, so if you keep picking the vegetables, the plants will keep trying to be fruitful and prosper. An old gardening joke says it's "against the law to plant more than two" because of how prolific this plant is. Really!

TIP

Bush zucchini also grows well in plant pots. Say you have a nice long deck that would benefit from some beautiful vegetation. Consider planting a zucchini plant or two in containers and placing them on that deck. Zucchinis are nice-looking plants, and if placed up on the deck and away from the soil (and the insect and the other wildlife pests), they may thrive even more than they do in the garden. Harvesting is even a little easier — just walk out on the deck every morning and pick off whatever veggie is ready!

Zucchini is one of those plants that pretty much grows itself. Toss two or three seeds directly into the soil (which you've mixed with fertilizer or compost) in late spring. Give them plenty of water and add organic fertilizer every four weeks or so. When the seedlings are about 4 inches tall, gently pinch off the weaker leaves.

TIP

Harvest the zucchini fruits when they're still small, maybe about 7 inches long (the size of a typical pickle). If you let them go, they continue to grow and can get downright huge — baseball bat-sized! Smaller fruits are more tender and contain fewer seeds. Of course, if a zucchini gets too big, you can grind it up for zucchini bread or consider feeding it to your critters — they'll love you for it.

Winter squash

Winter squashes favor the cooler months and last much longer in storage than summer varieties. Unlike summer squashes, winter squashes have a hard shell.

Many varieties of winter squash are available, and each type has its own amazing characteristics and tastes. Of all the possibilities, the most popular are pumpkins, butternut squash, and spaghetti squash.

Winter squashes are known for being easy to grow. Simply plant seeds in separate mounds about a yard apart and keep only the strongest seedlings — this practice keeps the plants strong and healthy.

After about 14 to 20 weeks, winter squashes are usually mature and ready to be harvested. Cut them off the vine, leaving at least 2 inches of stem. Store them in a dry place until you're ready to do something with them.

Legumes, the nitrogen-fixers

Legumes are plants that grow fruit in pods and help *fix* their own nitrogen — that is, they provide luxurious homes for beneficial bacteria that take nitrogen gas from the air and turn it into something the plants can use. In many cases, you don't have to fertilize the plants with nitrogen at all. These plants are also good to use in crop rotations because they return some nitrogen to the soil just by being planted there. The most popular legumes for small farmers are peas and beans.

Peas

Peas freeze and dry well, and with some peas, such as snap and sugar peas, you can even eat the pods. Peas are a cool-weather crop, so you should plant anywhere from late winter (provided your soil is workable) to early summer; then plant again in late summer/early fall. They don't do well in the heat of the summer.

TIP

To extend your harvest of fresh peas, try planting some in one area and then planting some in another area a couple of weeks later.

Because peas like a higher soil pH (lower acidity) than most vegetables, they benefit from having a little lime added to the soil along with compost or other fertilizer. (More on soil pH in Chapter 3 of this minibook.)

Plant legume seeds every 2 inches or so, and give the plants something to climb up, such as small sticks or fancy metal or plastic poles from your local garden store.

Some varieties can grow and climb very tall, which means they produce shade and can interfere with other plants around them. A good plan is to use the space around the pea plants for smaller, shade-tolerant plants, such as radishes.

Green beans

Green beans come in bush varieties, which stand up on their own, and pole varieties, which need some sort of support to lean on. Plant pole varieties from seed about 4 to 6 inches apart; bush varieties should be 2 to 4 inches apart.

Harvest green beans regularly to encourage the growth of more beans. Pods should be about 3 inches long. Hold the stem with one hand while picking the pods off carefully with the other. Do the picking in the morning, when the beans are still tender but after the dew has dried off. Picking from wet plants can spread *bacterial blight,* a disease that threatens the bean plant.

As with peas, you can plant a bed of green beans every couple of weeks to extend the harvest throughout the summer.

Tomatoes and peppers: The not-so-deadly nightshades

The nightshades are staples in most home gardens, and their fruits are both tasty and healthy. Tomatoes and peppers are nightshades, as are eggplants and tobacco. (Potatoes are nightshades as well, but are included later, in the "Root crops and tubers" section.)

WARNING

Tomatoes aren't poisonous as people once believed, but the leaves and stems of plants in this category can be toxic. Take care not to feed the green parts to the animals.

Tomatoes

If you grow only one type of vegetable, tomatoes are a good choice — they're easy and yummy. In foods, they go with pretty much everything, and very few earthly delights can beat that. Tomatoes contain lycopene, which has been linked to prostate health and can help with some other forms of cancer and heart disease.

TECHNICAL STUFF

Tomatoes contain flavonoids (flavor pieces), some of which can be activated only with alcohol! If you cook tomatoes with white wine, you can unlock these things and get a better flavor.

WARNING

After you've tasted a fresh-from-the-garden-tomato, you'll never be happy with a store-bought tomato again. Tomatoes you get in the store are picked before they're completely ripe so they'll last through the time it takes to get them from the farms to the shelves. These tomatoes do turn red, but turning red and ripening aren't the same thing. Vine-ripened tomatoes are the tastiest because as they ripen on the vine, they continue to get nutrients — and sugar — from the plant.

Bush tomatoes, the kind that don't ramble very far from the roots, set all the tomatoes at once. They have a short harvest season, but if you're canning, the bush tomato is a good kind to plant. Of course, they're not-so-good if you intend to eat fresh tomatoes all summer. Planting both varieties can ensure you have both fresh tomatoes all summer and canned tomatoes to enjoy in the winter.

Hundreds of varieties of tomatoes are available, from the itty bitty grape tomatoes to the massive beefsteak tomatoes, so-named because one slice can cover an entire sandwich. Plum or paste varieties such as the Roma are ideal for canning and sauces. Plant several types and find out which you like the best.

TIP

Start tomato seeds inside, six to eight weeks before the last killing frost. Starting them early gives them a chance to get big enough to be planted outside as soon as conditions allow. If you don't have a greenhouse where you can control temperatures, a good way to get the tomato plants started is to put them on top of your water heater. That gives them the warm and dark environment seeds like. Move them into the light as soon as they sprout.

Staking the plants has many benefits. It gets the vegetables off the ground, provides better air circulation, gives bugs fewer places to access the plant, and reduces the potential that a vegetable will rot on the ground. If you're going to stake the plants so they can climb, put the stakes in the ground first to protect the young roots. Put a little fertilizer in the soil as you plant the plants. An initial dose of fertilizer is enough, with maybe a little topical application later.

WARNING

If you treat a tomato plant too well by giving it lots of water and fertilizer, you'll end up with a beautiful plant that bears little fruit. What another plant may consider a good amount of nitrogen, the tomato sees as something to beef up its green parts. The ideal tomato plant is a little scraggly with beautiful, healthy fruits.

Pick your tomatoes as soon as they ripen, and you can get fruits all summer. As soon as the first frost comes, the plants are done. (Anything left on the vine turns to slime.) If you still have some green tomatoes when a frost is threatening, pick them off the vine and put them in a window. They won't ripen anymore, but they'll get red and soft.

Peppers

Peppers come in a ton of varieties as well as a rainbow of colors. They can be hot or sweet, round or oblong, with colors including ivory, purple, bright red, yellow, orange, or even brown. Of course, although brown peppers taste fine, they may not be the most aesthetically pleasing things to put in salads.

All peppers are green peppers first. When they ripen, they turn into their other color. That means green peppers aren't technically all the way ripe. (Other plants work that way, too. Olives, for instance, start out green, and you can pick and eat green ones, but the ripe ones are black.) Green peppers have a specific flavor; when they ripen to their final color, their flavor also changes: They tend to get sweeter. Fully ripe peppers also have more vitamin C.

Peppers are related to tomatoes, so growing and caring for them is pretty much the same (see the preceding section). Too much fertilizer results in beautiful, healthy, green plants with little or no peppers. Prepare the bed, put in a little fertilizer and maybe compost, and put in the already-started plants.

Corn

You can choose among three basic types of corn:

- **Sweet corn:** This is the stuff that goes to backyard barbeques. It doesn't store well and is best if eaten right away, because as soon as you pick it, the sugar enzymes start to turn into starch. The longer it sits, the less sweet it becomes. Plant two to three varieties a few weeks apart to extend the harvest.
- **Field corn:** This corn grows really tall (up to 12 feet high) and has little or no sugar in it. Its purpose in life is to be grown, dried, and then ground into corn meal or used in animal feed.

- **Popcorn:** Yes, you can grow your own popcorn. If you have kids, it could be kind of fun. But for as cheap as you can get ready-to-pop corn, growing it may not be worthwhile.

Corn plants are considered a heavy feeder, meaning they really abuse the soil they grow in. They leach out any nutrients they can. Corn plants especially suck out a lot of nitrogen, so fertilize relatively often.

TIP

For best results, plant a block of corn instead of rows. With corn, the pollen has to fall from the tassel onto the ear shoot in order to produce a mature ear. With a block (kind of a square area, maybe four rows planted with corn for about 5 feet), the plants can more easily cross-pollinate each other. The plants in the middle of the block get the most benefits, yielding the better ears of corn.

Corn likes a lot of water, but not from above, which washes away the pollen needed to make the ears. The best watering method is a drip system. In its simplest form, you simply lay a hose along the rows, cut small holes in the hose, and turn the water on at a low pressure.

Leaf crops and cruciferous veggies

In leaf crops, the leaves are the tastiest and most nutritious parts. Also in this section is a subcategory called *cole crops,* or *crucifers,* vegetables that belong in the mustard family, such as cabbage, Brussels sprouts, broccoli, cauliflower, collards, kale, kohlrabi, turnips, and watercress. All are delicious, but this section simply focuses on some of the more common and easy ones.

Lettuce and spinach

Lettuce and spinach are so good, and the animals love them, too. The main types of lettuce are leaf lettuce, butterhead (bibb is a popular variety), Romaine (also known as *cos*), crisphead (such as iceberg), and stem (or asparagus) lettuce. Spinach comes in three main varieties: savoy (what's sold in most supermarkets), smooth-leaf (which has larger leaves than savoy and is typically grown for canning and freezing), and semi-savoy (a hybrid between the two).

Lettuce and spinach favor cooler temperatures, so plant them in late spring or early summer. They like small amounts of water, administered often. Cut the leaves whenever you think they're big enough. The plant has a shallow root system, so be careful when you harvest — don't tug too hard or the whole plant could come up.

Lettuce and spinach are easy to grow, but they grow in such a way that slugs like to hang out in the leaves. Some other common pests include aphids (watch for a gathering of these guys on the underside of the leaves) and foliage rot, caused by too much water and too-hot temperatures.

Cabbage

With the many varieties of cabbage around, you should really try growing at least one. Green cabbage is by far the most popular, but others such as red or savoy can also be a nutritious and tasty addition to your diet. Cabbage contains vitamin C, and all sorts of good stuff are in sauerkraut, which is simply fermented cabbage; it boosts the immune system, helps fight cancer, and helps your digestive system run smoothly.

Cabbage likes cooler temperatures, and you can grow it either in the spring (plant six weeks after the last frost) or fall (plant eight weeks before the first frost). The trick to getting good plants is rich soil, good fertilization, and plenty of water.

TIP

To help warm up the soil more quickly for the spring planting, lay black plastic on the ground and poke a few evenly spaced holes where you'll then put the seeds.

The appearance of a head of cabbage doesn't necessarily mean it's ready for harvest. Give it a little squeeze, and don't harvest until the head is nice and firm and dense. Cut it from the base of the plant.

Broccoli

Broccoli is one of the easiest cole crops to grow. Modern broccoli varieties have been bred to form one large main head. This head is simply a tight cluster of flower buds. Once the main head is cut off, multiple side branches and mini heads form along the plant. In most areas, the side branches and mini heads continue to form until the plant is killed by frost, insects, or disease. So from one plant, you can harvest right through summer, fall, and winter (if your climate is warm enough).

REMEMBER

Choosing the right broccoli variety for your garden depends on a number of factors, including where you live and what you plan to do with the crop. Here are a few guidelines to follow when choosing a broccoli variety:

- If you plan to stock up for the winter by freezing broccoli heads, choose a variety with large heads that mature mostly at the same time. Try 'Green Magic' or 'Premium Crop'.
- Broccoli, like all cole crops, thrives in cool weather. Warm weather makes the heads flower too quickly, resulting in a bitter flavor. Gardeners in warm climates should choose varieties that withstand heat or mature early, before the heat of summer. 'Packman' is a good choice.
- If you want a long, steady production of small but tender side shoots, choose an old-fashioned variety with good side-shoot production, such as 'DeCicco'.

- If you live in a humid climate (such as Dallas) or a coastal area that has lots of fog and mist (such as San Francisco), broccoli heads can rot before maturing. Choose varieties with added disease resistance and tightly clustered flower heads that shed water easily, such as 'Arcadia'.

Brussels sprouts

Brussels sprouts are sweet and tender and delicious when steamed. They're very similar to cabbages and can cause a not-so-pleasant fragrance when cooked.

These plants do well in warmer temperature, so you should plant them in early to mid-summer. They do their growing during the heat of the summer, so be sure to keep them good and watered.

When the buds (or sprouts) get to be around 1 inch in diameter, you can pick or cut them off. As soon as the leaves start turning yellow, the plant is at the end of its growing season, and you should pick any remaining sprouts.

For best results, pinch the growth off the top of the plants after they're at least 2 feet high. This allows the plant to concentrate its energy on the buds in the lower part, making those buds denser.

Root crops and tubers

Root crops are those whose roots or underground bulb is the tasty thing you eat. Several plants fall into this category. The easiest to grow are the radish, onion, and carrot, but others include turnips, beets, parsnips, artichokes, leeks, garlic, and sweet potatoes. This section includes some popular root crops and *tubers*, which are enlarged underground stems.

Beets

Beets grow best in cool, moist conditions. Two weeks before the average date of your last frost, prepare a raised bed by working in a 2- to 3-inch layer of composted manure. Then sow seeds ½ inch deep and 2 inches apart. Cover the seeds with soil, and keep them well watered. Plant seeds again every two weeks into summer to ensure a continual supply of beets. (See Chapter 5 of this minibook for more on this succession planting technique.)

TIP

Beet seeds are actually tiny dried up fruits with many seeds inside. For this reason, one seed produces many plants. These plants really need to be thinned early. After the seedlings stand 2 to 3 inches tall, thin them to 2 inches apart; thin the seedlings to 4 inches apart a month later. Because many beet plants grow in the same area, try snipping off the seedlings that you don't want with scissors instead of pulling them out and disturbing the roots. Use the thinned greens in salad mixes to add color and flavor.

WARNING

Thinning root crops is essential if you want the roots to grow into beets, carrots, onions . . . whatever. If they don't have adequate space, you'll get a small vegetable or no vegetable forming in the roots.

Harvest the roots when they're golf-ball sized and the most tender. To see whether the beet is large enough to harvest, brush the soil off around the beet root; beets grow right at the surface of the soil, so it's easy to see the tops of the roots. But make sure you leave some beets to experience the cool weather that produces the sweetest fruits.

Carrots

Carrots are a great source of vitamin A, which aids in eyesight, builds the immune system, and promotes bone growth. They're a cool-season crop, and they need a lot of water, so they probably won't do so well in a dry climate. The best temperatures for growing carrots are between 60 and 70 degrees. You sow carrot seeds directly into the soil.

Potatoes

Potatoes, like tomatoes, are a member of the nightshade family. These tubers can be eaten at various stages of maturity, all of which are tasty and healthy, from the young *new potatoes* to the fully mature.

Potatoes need a soil that isn't sopping wet, but they can stand cooler temperatures, so an early spring planting works for them. Start plants by planting *seed potatoes* — use only certified ones that you get from a nursery to ensure they're disease free. A couple of weeks before you intend to plant, set these special potatoes somewhere that's warm and well-lit. When planting day comes, cut the now-sprouting seed potatoes into small chunks, making sure each chunk has at least one eye, and let the chunks sit for a day or two.

Mix the soil with some compost and put the chunks in the ground, maybe 15 inches apart. Give the plant a lot of water while it's growing, stopping at the end of the season, when the foliage starts to turn yellow and die. Let the tubers sit and mature for a couple of weeks and then harvest.

Too much organic matter can be damaging to potato plants and can cause a disease called *scab,* which makes them aesthetically unappealing but doesn't ruin their nutritional benefits.

Radishes

Radishes are some of the easiest vegetables to start out with. They do well in all climates and mature really quickly, going from seed to table in as little as four weeks. And because they grow so quickly, the bugs usually don't have a chance to infest them.

Mix compost into the soil prior to planting, and then all you have to do is provide sufficient water. Instead of planting in rows, spread seeds out in a small patch (1 or 2 square feet). Harvest as soon as they get to be a size that looks good. If they get too big, they become woody, and after the plant goes to seed, the radishes aren't worth eating.

WARNING

Don't plant radishes where dairy goats can get into them, and don't feed them to the goats. Radishes negatively affect the taste of the milk.

Garlic

If any vegetable has experienced a renaissance lately, it has to be garlic (*Allium sativum*). Now the chic ingredient in many gourmet restaurants and touted as a major medicinal herb to cure everything from earaches to high cholesterol, garlic also is a key ingredient in some insect and animal repellents.

Many also believe that garlic is difficult to grow. That isn't true. Even though you could grow your own garlic from bulbs bought in grocery stores, most of those varieties are adapted to a California climate. Unless you live in central California where most garlic is commercially grown, it's best to select varieties from catalogs and local garden centers.

Garlic likes cool weather conditions and requires a long time to mature its bulbs. For gardeners in cold areas or areas with hot summers, fall is the best time to plant garlic. For gardeners with mild summers and winters, garlic also can be planted in spring. Garlic needs well-drained soil — if the crop fails, it's usually due to the cloves rotting in wet, cool soil. Fertilize the beds as you would for onions.

After harvest, let the bulbs *cure* (toughen their skins) in a warm, dry, airy place for a few weeks. Garlic flavor is enhanced in storage; cloves often taste best after stored for a few months.

Onions

The first year you grow an onion, the plant forms a bulb. The second year, the plant goes to seed if you haven't harvested the bulb, so you can save the seeds but the bulb is no longer useful as a food product. Thus, the plant lives for only two seasons.

The length of the day determines when onions form a bulb, so certain types of onions work best for certain parts of the country:

- **Long-day onions,** such as 'Walla Walla', are better suited to gardens in the northern half of the U.S.
- **Day-neutral onions,** such as 'Stockton Red', do well anywhere.
- **Short-day onions,** such as 'Vidalia', grow better in the southern part of the U.S.

If you're starting onions from seed, plant them in April so the plants have a chance to get strong before the warm weather and amount of daylight triggers the bulbs to begin forming. If you're using seedlings or sets (small bulbs), wait about another month so the colder weather doesn't stimulate seed development instead of bulb development.

When most of the tops have fallen over, the onions are ready for harvest. Pull the bulbs out of the ground, rinse them off, and let them dry out for a couple of days. Then cut the tops and roots and let them sit another day or two. Now they're ready to eat or store for later.

Leeks

Cousin to the onion, the leek is a little easier to digest and makes a great addition to many recipes where you'd otherwise use onions.

Leeks are a cool-weather crop, and they like full sun and well-drained soil. They need a reliable watering schedule — about 1 inch per week — or the stems get too tough. To get them to grow large, succulent, and white, blanch the lower part of the stem by piling dirt around the stalk as it develops. In midsummer, start removing the top half of the leaves to encourage stalk growth.

They're typically ready to harvest in the fall, when they're about as thick as a finger.

Stem crops

Asparagus, rhubarb, and celery are three types of plants whose edible parts are the stems. Other stem crops include hay and alfalfa, but because this section concerns vegetables and because celery isn't very easy to grow, the only ones discussed here are asparagus and rhubarb.

Asparagus

Unlike most other vegetables, asparagus is a perennial plant, meaning it comes back year after year. In other words, you have to plant it only once. If you care for it properly, it may last 15 years or more.

You usually have to wait a couple of years before the plant bears any edible shoots. In the first and second seasons, the plant concentrates on building up a stable root system. Around the third season, you finally see spears that you can harvest.

Wait until the spears are about 3⁄8 of an inch or more in diameter before you harvest them. Make a cut just below the ground to enable the cut to properly heal, or snap off the spears at soil level. You can expect to get eight to ten sprouts per plant the first harvest year and more as the plant continues to mature.

WARNING

Never take everything when you harvest asparagus; instead, plant extras and pick what you want without depleting the whole crop. Leaving some makes for a healthier crop.

TIP

Asparagus does especially well in moist environments. Plant them on banks of a canal, creek, or river you have running through your property and benefit from healthy plants that also help keep bank erosion down.

Rhubarb

Another hardy cool-weather plant, rhubarb is drought resistant and can do well in most soils, but it loves well-drained soils enhanced with organic matter.

To get the best stalk growth, remove flowers as they appear. Don’t harvest the stalks until their third year. In the first two years, the stalks and leaves are nourishing the roots. Beginning the third year and ever after, the stalks may be picked all at once or individually over the next four to six weeks. After the stalks are cut, you can remove the leaves.

WARNING

The leaves of rhubarb are toxic, so don’t feed them to animals.

Planting Other Small-Scale Crops

Besides vegetables, other crops may do well on your backyard homestead and add some joy to your menus or those of your friends and neighbors. If you have the space and an interest in making a little money on the side, you can grow these flowers, fruits, and nuts and market them to local restaurants or grocery stores. You may even get a booth at a farmer’s market or set up your own roadside stand. (Be sure to check with local laws to be sure you’re legally selling your wares.)

Letting business bloom with flower gardens

Who doesn't like the beauty of colorful and fragrant flowers adorning the landscape around the house? Besides adding to the aesthetics of your own outside look, you may consider growing flowers to either grace your own table (or desk or bureau top) or provide the materials for drying or pressing for subsequent use in crafts. Or you can sell fresh flowers to the local flower shop.

Although the staples such as roses, carnations, and daffodils are popular and often in high demand in local floral shops, you may find an even more lucrative side business in growing exotics such as lilies or orchids.

Ask around. See what the local flower shops are lacking, and find out whether they're open to accepting product from a local homesteader.

Aiming higher with fruit- and nut-bearing trees

Not everybody can grow fruit and nut trees, but if your soil supports them, they can be a lot of fun. Fruits and nuts are a great way to supplement your own diet as well as your income. The best way to figure out what you can grow is to check with a local nursery.

Fruit trees

How cool is it to go out into your backyard, pick a fruit, and then take a bite, tasting a tremendously sweet, healthy snack?

You can choose fruit trees in dwarf, semi-dwarf, or standard sizes. If you choose a fruit that requires cross-pollination, such as apples or plums, you need at least two trees.

You should prune, water, and fertilize your tree to keep it as healthy as you can so it produces the best (and most) fruit. Bees are a godsend for pollinating the flowers.

After you have a good, reliable supply of fruit, contact local grocery stores or even consider setting up a booth at the summer farmer's market or a roadside stand.

Nuts

Historically shunned by the average dieter for being high in calories and fat, nuts are welcomed with open arms by hikers and backpackers and others who regularly do some moderate to heavy exercise. However, people are reconsidering the health benefits of nuts for daily consumption. They're high in protein and rich in fiber, and they contain antioxidants. The fats they provide are the healthy ones — the much lauded omega-3s — so there's definitely a market for nuts.

Several varieties of nuts work on a small farm operation. Growing up, I was regularly treated to English walnuts from the big old tree in my backyard. Nuts grow better in loamy or sandy soils and don't do as well in soils with a lot of clay.

Prune, water, and fertilize your tree as needed. A new tree takes three to four years to be mature enough to produce nuts, and after the nuts start coming, they'll continue every year until the tree dies.

Another idea for using the nut tree is to sell the wood. A lot of nut tree wood is used in smoking. For instance, people often use hickory tree wood in smoking bacon.

WARNING

The black walnut tree produces *juglone,* a substance that can be toxic to plants growing around the tree's base. Avoid planting sensitive plants such as tomatoes, peppers, cabbage, or eggplant nearby.

Growing berries and grapes: Fruit bushes and vines

Growing berries yourself means the fruits can be more natural — there'll be no pesticide residues or preservatives — but that also means they need to be eaten, dried, frozen, or baked within a few days of picking. Homegrown berries can be a lot cheaper than store-bought ones — you may even sell them to the store!

Blueberries

Blueberries thrive in full sun and grow on handsome, perennial shrubs that range in height from 2 to 6 feet, depending on the type. You can choose from *low-bush* (1 to 2 feet tall), *half-high* (2 to 4 feet tall), and *high-bush* varieties (5 to 6 feet tall) that can fit into many locations in your yard. They have pretty white flowers followed by large clusters of tasty, blue fruit. Berries appear the second year after planting. The attractive green leaves turn bright shades of red, orange, and yellow before dropping in the fall. Blueberries make an excellent foundation plant grown up against the house or grouped to form a hedge between properties.

REMEMBER

Blueberries must be grown in acidic soil (with a pH level between 4.5 and 5.5), so if you don't have that kind of soil, you need to make some adjustments. Amending your soil with a lot of peat moss and some sulfur is one easy way to lower the soil pH; see Chapter 2 of this minibook for more on soil pH and amending your soil.

Plant at least two different blueberry varieties to ensure good pollination and fruit set. Variety selection is the key to success. Blueberries grow best in areas with cold winters and mild summers. In hot-summer areas of the South, grow blueberry types that are adapted to the heat, such as Southern blueberries or rabbit-eye blueberries. In cooler climates, all other blueberry types are fine to plant.

Raspberries

Raspberries are versatile. Peach melba wouldn't be the same without them, and raspberries make a beautiful jam or preserve. And who doesn't like raspberry vinaigrette, adding a hint of sweetness to a salad?

These berries grow in the wild. Have you ever taken a hike — or even a walk in a city center — and seen wild raspberries growing by the side of the road or trail? Well, that goes to show you how easy they are to grow in your own yard. Only the nastiest of soils disallow a raspberry bush.

Raspberries are typically started from a crown: An established plant throws out underground shoots, and those shoots periodically throw a stem and leaf up out of the ground, a new plant called a *crown.* Be sure to get crowns from a place that can certify the crowns are disease free — most home and garden stores are a good bet. Then harvest as you see the berries appear. It takes a raspberry bush two to three years to produce berries.

Strawberries

Fresh strawberries are one of life's little treats. You can put them on waffles, on cold cereal, or into the blender to make strawberry or strawberry-banana milkshakes. You can make jam or even bake them into muffins. And don't forget just dipping your hand into a bowl and eating them au naturel!

Strawberries come in two basic types:

- **June-bearing:** These are usually the better-quality berries. They set all at once, giving you gobs of berries at one time. If your intention is to make jams, these are the ones to use.
- **Everbearing:** This type produces a few berries at a time, but in a more extended growing season. If you want to have berries as snacks or as additions to your desserts, these are the ones.

Strawberries, like raspberries, do better if started from an established plant. In a process called *daughtering,* a strawberry plant sends out aboveground shoots. Plant one of these daughters directly in the ground and wait for berries.

The way to keep the strawberry plant healthy is to periodically prune back the older or weaker, scrawnier parts of the plant, allowing the newer or stronger parts to thrive.

WARNING

Don't plant strawberries where you've planted nightshades (tomatoes, peppers, potatoes, or eggplants). Nightshades can harbor *verticillium wilt*, a serious strawberry disease.

Growing Herbs for and in the Kitchen

If you decide you don't have the time to invest in a garden or a larger crop but still want to grow something, you can always plant some herbs in small pots and keep them indoors. If you have a few well-lit windows, these plants can supply you with exotic flavorings year-round. Here are some of the easiest to get, in Table 2-1, but there are tons of others.

TABLE 2-1 Types of Herbs and Their Uses

Herb	Uses
Anise	Has the scent and flavor of licorice; very good in salads and baking.
Basil	Probably the most popular homegrown herb. Used in many foods, especially pesto and tomato-based recipes.
Caraway	Use it to flavor rye bread. It's also good in coleslaw and Hungarian-style dishes and meat stews.
Catnip	Cats go into a hypnotic trance when they get a whiff of catnip; it's like marijuana for cats, although it's a harmless treat for them.
Chives	An onion-like plant that's popular with baked potatoes.
Cilantro	Use cilantro in foods such as chili, salsa, and pico de gallo. (Note: The seed, coriander, is common in Indian curries; ground, it's in many baked goods.)
Dill	Seriously yummy with potatoes (consider sour cream and dill dip with potato chips, in potato salad, or on baked potatoes), in sauerkraut, or with pork roast.
Fennel	Has an anise-like flavor that becomes delicate when cooked. Use it in salads, in cheese spreads, or on vegetables or fish.
Lavender	Dry and use it in sachets and perfumes; the fragrance is amazing.
Marjoram	Good in cooking — sprinkle it over sliced tomatoes or baked fish. Also use it in perfume.
Oregano	Adds that extra spark to Italian-style recipes, especially pizza, lasagne, or good old-fashioned spaghetti

Herb	Uses
Parsley	High in vitamins A and C, this herb is versatile. Use it as a garnish; to flavor soups, meats, or pastas; or in ethnic foods such as tabbouleh or parsley pesto.
Mint	Besides the food-related uses of mint (tea is one of the biggies), mint's a good plant to grow and place strategically to ward off mice.
Rosemary	Rub a pork roast with rosemary before cooking — seriously yummy.
Sage	Add sage to stuffing or sprinkle it on baked fish and most meats, especially poultry, rabbit, and pork.
Savory	Comes in a summer and a winter variety (summer is sweeter); both are used to flavor meats and vegetables.
Tarragon	Similar to anise. Use it in salads, sauces, and marinades.
Thyme	Especially good in slow-cooking beef dishes, clam chowder, or poultry stuffing.

TIP

Indoor herbs do better if they're well ventilated and away from cooking fumes. Typically, the bushy, perennial herbs — rosemary, thyme, oregano, sage, and winter savory — perform better indoors than those with soft stems, such as mint and tarragon.

Get seeds or starts at a local nursery and ask the salesperson for suggestions. He or she may suggest something you've never heard of but that turns out to be just right for your favorite recipe. Use your herbs fresh or dry them for later use.

Scented geraniums make wonderful, fragrant herbal roommates, as do lemon verbena, basil, coriander, and some varieties of lavender.

TIP

Plant dill, fennel, and parsley, and you may end up with caterpillars from the black swallowtail butterfly. You may want to plant extra so you can transfer all the caterpillars to a single plant and still have some herbs for yourself.

IN THIS CHAPTER

- **Getting your garden soil ready for vegetables**
- **Thinking ahead to your watering and fencing needs**

Chapter 3

Preparing to Plant

The work you put into your garden beds *before* you plant may be more important than anything you do after plants are in the ground. Sure, meticulous prep won't ensure a bountiful harvest. But skipping the important advance work will guarantee less-than-spectacular results.

Gardening wisdom says that to grow healthy plants, what you need to do is build healthy soil. And that's a big part of what this chapter is about: getting the ground ready for gardening. You'll do that by clearing your garden space, figuring out what you have to work with already in terms of soil, adjusting your soil to optimize growing conditions, and preparing it for actual planting.

But it's also the ideal time to think ahead to things such as how you'll water your plants, enclose areas of the garden that you want protected or just partitioned off from the rest of the yard, and get around the garden as you maintain your homestead. All of these things are easier to add now while your garden is still a blank slate.

This chapter helps get you ready for long-term gardening success without putting a single plant or seed in the dirt.

Razing Your Garden Spot

After you choose a good sunny spot for your vegetable garden and draw a plan on paper (see Chapter 1 of this minibook if you haven't completed this early-stage conceptual work), you need to clean up the area so the soil will be easier to work. You can clear your garden area any time during the year, but the season before planting works best — clear in the fall for spring planting, clear in the spring for summer or fall planting. You can clear the area the day before you plant, but you may have more weed problems later.

If you already have an established garden, clean up any debris in fall or winter, depending on where you live, and till the ground before planting.

REMEMBER

Here are the basics of initially clearing a garden spot:

1. **Outline the areas of your garden plot that you want to clear.**

   You outline the areas depending on how you want the plots to be shaped. Follow these guidelines:

   - To get your edges straight for a square or rectangular vegetable plot, stretch a string between sticks and mark the line with a trickle of ground white limestone, available at garden centers, or marking spray paint.
   - For a round garden, use a hose or rope to lay out the area, adjusting the position to create a smooth curve.
   - If you want several individual beds separated by permanent paths, outline each bed independently so you don't waste time improving soil that you'll never use. But if you think that you may change your garden layout from season to season or year to year, work the entire area within the outline. (For more on adding walkways, see the section titled "Planning for Pathways" at the end of this chapter.)

2. **Clear the surface by first removing plants, weeds, brush, and rock. If necessary, mow the site to cut back the grass and weeds close to the surface of the soil.**

   See the section "Killing weeds and aggressive grasses," for details on removing weeds.

3. **Dig out the roots of small trees and tough weeds with a hoe, shovel, or pick ax.**

4. **After the vegetation is manageable, remove any sod.**

   See the section "Stripping sod" for details on how to do this.

Killing weeds and aggressive grasses

If your garden area contains a lot of perennial weeds, such as quack grass or is lawn composed of vigorous grasses (such as Bermuda grass), make sure that you first kill those weeds or grasses. You can pull out or mulch seedlings (see Chapter 5 in this minibook for more on mulches and weeding), but many aggressive weeds and turf spread by underground roots as well as seeds. Those underground roots can haunt you for eons.

If you have an existing garden, you have to be diligent about weeding, or you may need to start all over again with tilling and removing as much of the weed's root system as you can.

You can kill weeds and aggressive grasses two ways:

- **Hand dig and sift:** For a small garden, dig up the earth and carefully sift the soil, removing sod and root parts that may come back next year as weeds (see the tip on sifting compost in Chapter 5 of this minibook).
- **Apply a covering:** An easy, chemical-free way to clear your garden is to cover it with clear or black plastic, cardboard, or even old rugs. After a month under these impermeable coverings, existing plants die from the lack of sunlight. You must plan ahead to use this method. It may not look pretty, but it works like a charm — especially on annual weeds. For perennial weeds, you may need to dig out their roots, too, after applying the plastic.

  You can buy plastic in rolls at hardware stores or home improvement centers. Check department stores for old pieces of cardboard (big appliance boxes cover a large area and are nice and thick) and carpet stores for old rugs. Use the thickest plastic or cardboard you can find — it should be at least 2 millimeters, but 4 millimeters is even better.

Controlling weeds and grasses by applying a covering to your garden area is easy. Just follow these steps:

1. **Spread the covering over your entire garden area, securing the edges with spare rocks, bricks, or boards.**

   Let neighboring pieces overlap by several inches so no light can penetrate. If you're using old rugs, place them nap side down.

2. **After a month, remove the covering and strip off any grass or weeds.**

   Use a shovel to cut off any grass or weeds at the root level (just below the soil surface). If they aren't too thick, rototill them into the ground.

3. **Wet the area and wait about 10 days for weeds to sprout.**

   Leave the covering off; you want weeds to sprout. You should get some growth because you haven't removed weed seeds.

4. **Use a hoe to kill the weeds.**

   Hoeing the weeds down is sufficient to kill annual weeds, but if you have perennial weeds, you need to dig out the roots. Check out the National Gardening Association's Weed Library (`www.garden.org/weedlibrary`) for help identifying the weeds in your garden.

TIP

For an organic approach to killing weeds and building your garden soil, try a no-till layered garden technique (see Figure 3-1). It's like making lasagna. The season before planting, lay a layer of black-and-white newspaper three to four sheets thick over the garden area. Water the paper to keep it in place. Cover the newspaper with a 6-inch layer of hay or straw. Top that with 1- to 2-inch layer of compost. By the next planting season, the layers will have killed the grass and most of the annual and perennial weeds in your garden. You can hand pull any tenacious perennial weeds that survived. Earthworms will have munched up much of the newspaper, turning it into valuable compost. You can plant your seedlings right into the mulched layers, and they'll grow like weeds — but even better.

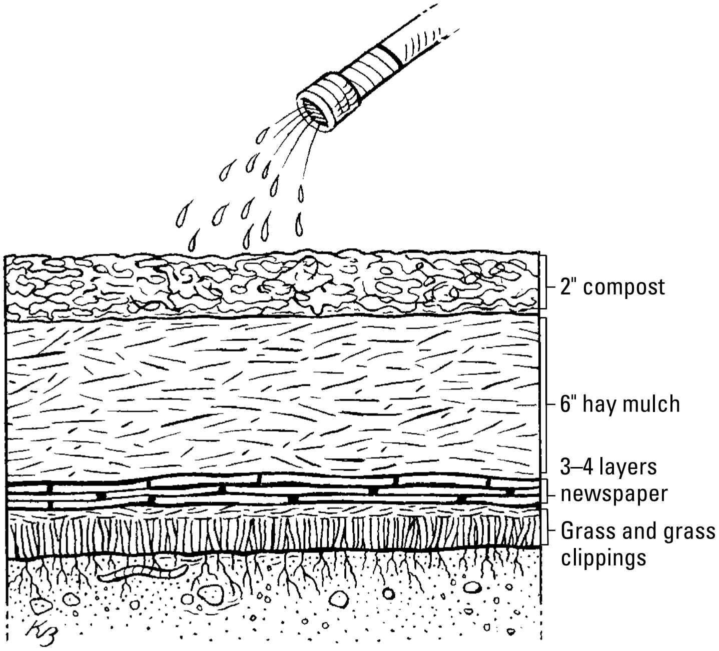


FIGURE 3-1: Creating a no-till layered garden.

Stripping sod

If you don't want to try the techniques in the preceding section, you can immediately remove the lawn grass by stripping the *sod* (grass and roots) before planting. If your lawn consists of bluegrass and other less-spreading grasses, you can strip the sod without first killing the grass; most lawns in the northern United States consist of these types of grasses.

You should kill weedier grasses, such as Bermuda grass, before you strip the sod (see the preceding section for details on killing weedier grass). Stripping sod takes a lot of effort, but it works. Just follow these steps, and have your wheelbarrow or garden cart handy:

1. **Water the area that you want to clear for 15 minutes for each of the 2 days prior to digging up your sod.**

   Stripping sod is easier when the ground is slightly moist.

2. **Starting at one end of your plot, slip a spade under the grass and slide it under the sod.**

   TIP

   An easier method is to precut the sod into square or rectangular sections and then loosen each section with a spade. Either way, don't dig too deep; you just want to remove the sod and 1 to 2 inches of roots. You also can use a rented sod stripper to cut the sod into rows that you roll up and remove.

3. **Pivot your spade up and let the sod flip off the spade and back onto the ground. Use your spade to slice off the sod section, toss the sod into a wheelbarrow or garden cart, and take it to a compost pile.**

   TIP

   If your sod has healthy grass with few weeds, and you don't want to compost it, use it to patch bare spots in your lawn. Keep it well watered, and it should root and blend in with the existing grasses.

4. **Repeat Steps 2 and 3 until your garden is cleared of sod.**

These steps should clear all the grass in your garden. You'll get new growth only if you have an aggressive grass such as Bermuda and don't kill all the roots.

Analyzing and Improving Your Soil

After clearing your garden area, you need to take a close look at your soil — give it a good squeeze, have it tested, amend it, and then work it out to make sure it's in shipshape. Good soil gives vegetable roots a balance of all the things they need: moisture, nutrients, and air. And knowing your soil type enables you to counteract problems that you may face when gardening on that piece of land.

Distinguishing different types of soil

Three main types of soil exist, with a lot of variations in between. Hard clay is at one end of the spectrum; soft, sandy soil is at the other end; and loam is in the middle. Being familiar with your soil helps you know what to expect when gardening. Clay soil tends to have a lot of natural fertility but is heavy to work with and doesn't drain water well. Sandy soil, on the other hand, drains water well (maybe too well) but doesn't have a lot of natural fertility. Loam, the ideal soil, is somewhere in between the two.

Here are general characteristics of the three basic types of soil:

- **Sandy soil** is composed of mostly large mineral particles. Water moves through this soil quickly, taking nutrients with it. Sandy soil is well aerated, quick to dry out and warm up, and often lacks the nutrients that vegetables need.
- **Clay soil** consists of mainly small particles that cling tightly together and hold water and nutrients. It's slow to dry out and warm up, and has poor aeration, but it's fertile when it can be worked.
- **Loam soil** is a happy mixture of large and small particles. It's well aerated and drains properly, but it can still hold water and nutrients. This is *the* soil to have for a great vegetable garden.

TIP

To find out what type of soil you have, grab a handful of moist soil and squeeze it, as shown in Figure 3-2. Then use these guidelines to determine what type of soil you're working with:

- **Sandy soil** falls apart and doesn't hold together in a ball when you let go. It feels gritty when you rub it between your fingers.
- **Clay soil** oozes through your fingers as you squeeze it and stays in a slippery wad when you let go. Rubbing clay soil between your fingers feels slippery.
- **Loam soil** usually stays together after you squeeze it, but it falls apart easily when you poke it with your finger.

If you have sandy or clay soil, don't despair; you can improve your soil and make it more like loam. Check out the section "Adding organic matter (aka the dead stuff)," later in this chapter, for details.

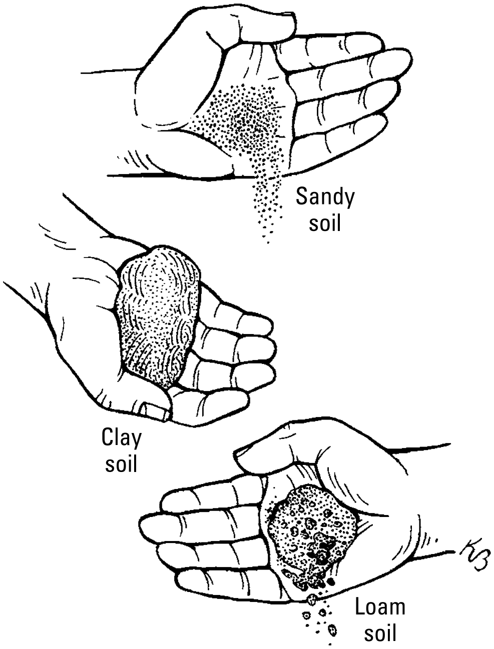


FIGURE 3-2: Squeeze your soil to find out what type you have.

Testing your soil

Vegetables are picky about soil chemistry. Too much of this nutrient or too little of that nutrient, and you have problems. For example, when tomatoes grow in soil that's deficient in calcium; they develop blossom-end rot. Yuck. Sometimes too much of a nutrient, such as nitrogen, causes lots of leaf growth on plants (such as peppers) but few fruits. Getting the levels just right is important for the best harvest.

In addition to nutrient levels, soil pH also is an important factor in plant growth. The right pH enables vegetables to use nutrients from the soil. Soil is rated on a pH scale, with a pH of 1 being most acidic and a pH of 14 being most alkaline. If your soil's pH isn't within a suitable range, plants can't take up nutrients — such as phosphorus and potassium — even if they're present in the soil in high amounts. On the other hand, if the pH is too low, the solubility of certain minerals, such as manganese, may increase to toxic levels.

REMEMBER

Most vegetables grow well in a slightly acidic soil with a pH between 6 and 7. Potatoes, including sweet potatoes, prefer a slightly more acidic soil, in the 5 to 6 range. But in general, if you aim for a soil pH between 6 and 7, your vegetables should grow well.

The only way to find out whether your soil will be to your vegetables' liking is to test it. Don't worry; analyzing your soil isn't complicated, and you don't need a lab coat. Here are two ways that you can test your soil:

- **Use a do-it-yourself kit.** This basic pH test measures your soil's acidity and alkalinity and sometimes major nutrient content. Buy a kit at a nursery, follow the instructions, and voilà — you know your soil's pH. However, the test gives you only a rough picture of the pH and nutrient levels in your soil. You may want to know more about your soil.
- **Have a soil lab do a test for you.** A complete soil test is a good investment because a soil lab can thoroughly analyze your soil. Here's what you can find out from a soil lab's test in addition to the pH level:
  - **Your soil's nutrient content:** If you know your soil's nutrient content, you can determine how much and what kind of fertilizer to use. In fact, many soil tests tell you exactly how much fertilizer to add; see Chapter 5 of this minibook for more on fertilizer.
  - **Soil problems specific to your geographic region:** A soil test may help you identify local problems. The soil lab should then give you a recommendation for a type and amount of fertilizer to add to your soil. For example, in dry-summer areas, you may have salty soil; the remedy is to add *gypsum,* a readily available mineral soil additive.

  Soil labs charge around $20 to $30 for their basic services. Your local Cooperative Extension Service office or a private soil lab can conduct a complete and reliable soil test. To locate a private lab, look in the phone book under *soil testing* (or search the Internet for soil test labs around the country). You also can ask your Cooperative Extension Service office for recommendations.

TIP

Fall is a good time to test soil because labs aren't as busy. It's also a good time to add many *amendments* (materials that improve your soil's fertility and workability) to your soil because they break down slowly.

To prepare a soil sample to use with a do-it-yourself kit or to send to a soil lab, follow these steps:

1. **Fill a cup with soil from the top 4 to 6 inches of soil from your vegetable garden, and then place the soil in a plastic bag.**
2. **Dig six to eight similar samples from different parts of your plot.**
3. **Mix all the cups of soil together; place two cups of the combined soil in a plastic bag — that's your soil sample.**

After you've collected your sample, consult the instructions from your soil test kit or the testing lab.

REMEMBER

If you're testing a soil imbalance — a known problem that you've identified in either pH or nutrients — you may want to test your soil every year because changes in pH and most nutrients are gradual. A home testing kit is a good way to test a pH imbalance. For nutrients, you may want to do a yearly test at a lab until the imbalance (high or low levels of a nutrient) is fixed. To maintain balanced soil, test it every three to five years.

Adjusting soil pH

Most garden soils have a pH between 5.5 and 8.0. This number helps you determine when and how to adjust your soil's pH level. The following guidelines help you interpret this number:

- If the number is below 6, the soil is too acidic, and you need to add ground limestone.
- If the measurement is above 7.5, the soil is too alkaline for most vegetables, and you need to add soil sulfur.

The following sections explain how to figure out how much lime or sulfur to add to your soil and how to apply the materials.

Calculating how much lime or sulfur you need

All Cooperative Extension Service offices, any soil lab, and many lawn and garden centers have charts showing how much lime or sulfur to add to correct a pH imbalance. The charts tell you how many pounds of material to add per 1,000 square feet, so you need to measure the size of your vegetable garden first. Then use Tables 3-1 and 3-2 to figure out how much lime or sulfur you need to add to your soil.

TABLE 3-1 Pounds of Limestone Needed to Raise pH (per 1,000 Square Feet)

pH	Number of Pounds for Sandy Soil	Number of Pounds for Loam Soil	Number of Pounds for Clay Soil
4.0–6.5	60	161	230
4.5–6.5	50	130	190
5.0–6.5	40	100	150
5.5–6.5	30	80	100
6.0–6.5	15	40	60

TABLE 3-2 Pounds of Sulfur Needed to Lower pH (per 1,000 Square Feet)

pH	Number of Pounds for Sandy Soil	Number of Pounds for Loam Soil	Number of Pounds for Clay Soil
8.5–6.5	45	60	70
8.0–6.5	30	35	45
7.5–6.5	10	20	25
7.0–6.5	2	4	7

REMEMBER

In general, soils in climates with high rainfall — such as east of the Mississippi River (particularly east of the Appalachian Mountains) or in the Pacific Northwest — tend to be acidic. West of the Mississippi, where less rainfall occurs, soils are more alkaline. But regardless of where you live in the United States, you should easily be able to find the lime or sulfur that you need at your local garden center.

Applying lime or sulfur to your soil

The best way to apply sulfur and limestone to your soil is to use a *drop spreader* (the same machine you may use to apply lawn fertilizer). This simple machine doesn't cost very much, and it helps you spread the material more evenly. Some nurseries may even loan you a spreader or allow you to rent one inexpensively. You also can spread these materials by hand if you're careful and wear gloves. No matter how you spread the materials, make sure that you work the soil well afterward.

You can purchase and apply different types of limestone to your soil. The type you use may depend on the type of nutrients your soil needs:

- **Dolomitic limestone** contains magnesium as well as calcium. Magnesium is one of the nutrients that a soil lab may test for, and even though it isn't in the top three (nitrogen, phosphorus, and potassium), it's as important as calcium for plant growth. Use dolomitic limestone to adjust the pH if your soil test shows that your soil is low in magnesium.
- **Pulverized limestone** is the most common and inexpensive acid neutralizer. Use this limestone if you don't need to add magnesium to your soil.
- **Pelletized pulverized limestone** is a little more expensive than ordinary pulverized limestone, but it's cleaner, less dusty, and easier to use than both dolomitic and powdered limestone.

Sulfur usually comes in only powdered form or mixed with other nutrients such as ammonium sulfate.

REMEMBER

Your soil uses limestone and sulfur most efficiently when it's tilled into the soil to a depth of 4 to 6 inches.

Adding organic matter (aka the dead stuff)

If you're like most people, your garden doesn't have perfect loam soil. So to fix that mucky clay or loose sand, you need to add *organic matter* — once-living stuff such as compost, sawdust, animal manure, ground bark, grass clippings, and leaf mold (composted tree leaves). You can't change your soil type (clay, sand, or loam), but adding organic matter makes your soil more like loam, which is perfect for vegetable roots. Even if you have loam soil, you still should add organic matter to your soil every year.

WHAT IS ORGANIC GARDENING?

Organic gardening has become a household term in the past 20 years or so. Many people are choosing organically grown produce from the grocery store because they feel it's safer and healthier. Because organic produce costs more than conventionally grown produce, it's a good idea to grow your own.

Organic gardening, in many ways, is just good, simple gardening practices and common sense. Some of the basic facets of organic gardening include the following, covered more in-depth in Chapters 4, 5, and 6 of this minibook:

- Feeding the soil — not just the plants — with organic fertilizers, manure, and organic matter
- Rotating crops
- Planting a diverse group of crops
- Solving pest problems by planting disease-resistant varieties
- Using barriers (covers that keep bugs away from plants)
- Releasing beneficial insects
- Using the least harmful biological and plant-based sprays

The USDA now has a certification program for organic farms, and the fertilizers and pesticides that can be used on these certified farms are widely available at local garden centers and through the mail. But you don't have to be certified to grow plants organically. A good philosophy is to emphasize compost and soil-building practices and to use sprays only as a last resort (and even then use only organic ones).

Organic matter improves garden soil in the following ways:

- It helps loosen and aerate clay soil.
- It improves the water- and nutrient-holding capacity of sandy soil.
- It provides the once-living material that attracts microorganisms, beneficial fungi, worms, and other soil-borne critters that improve the health of your vegetables.

REMEMBER

Work some organic matter into your soil before you plant each season. If you're using unfinished (raw) organic matter such as leaves or undecomposed manure, add it to your soil at least 1 month before planting. That way it will break down before you plant. Add finished compost and manures just before planting.

Follow these steps to add organic matter to your garden soil (for information on the best kinds of organic matter, see the following sections):

1. **Add a 1- to 2-inch layer of organic matter to the area where you intend to plant your vegetables.**

   Go for the higher end (2 inches) if your garden is new or if your soil is heavy clay or very sandy. Use less if you've grown there for years or if your soil is loamy and fertile.

   TIP

   You need 3 cubic yards of compost to spread a 1-inch layer over 1,000 square feet.

2. **Work in the organic matter to a depth of at least 6 inches.**

   There's nothing glamorous about spreading manure. The best way to spread organic matter is with a wheelbarrow and a shovel. Work it into the soil with a shovel, iron fork, or rototiller.

The best choice: compost

The best organic material to add to your soil is compost. Composting breaks down yard waste, agricultural waste, wood scraps, and even sludge into a crumbly soil-like material called *humus.*

Compost is usually clean, easy to use, and available. You can buy it in bags or have it delivered by the truckload. Most waste disposal sites make compost and sell it relatively cheap. You also can make your own compost; see Chapter 5 of this minibook for details.

Other organic materials, such as sawdust and manure

Using organic materials other than compost — such as sawdust and manure — is fine, but these materials present a few problems that compost doesn't. Here are some advantages and disadvantages:

- **Sawdust** adds organic matter to your soil, which eventually breaks down and forms humus. However, the sawdust also robs the soil of nitrogen when it decomposes, so you have to add more fertilizer to compensate.
- **Livestock manure** improves your soil's nitrogen level. However, livestock diets often include lots of hay that's full of weed seeds, which may germinate in your vegetable garden. Some manures (such as horse manure) add organic matter and some nutrients to your soil, but they're also loaded with bedding materials (such as dried hay) that cause the same problem that adding sawdust causes.

TIP

If you use manure, make sure it's *fully composted* — that is, it has been sitting around for a year or two, so it's decomposed and the salts have leached out. Too much salt in the soil can be harmful to plants. Good-quality compost or fully decomposed manure should have a dark brown color, an earthy smell, and little original material visible.

Turning Your Soil

After adding nutrients and amendments to your soil, you need to mix them up. Turning your soil to mix the amendments enables them to break down faster and be available where the roots can use them.

If your soil is dry, water well, and let it sit for a few days before digging. Then, to determine whether your soil is ready to turn, take a handful of soil and squeeze it. The soil should crumble easily in your hand with a flick of your finger; if water drips out, it's too wet.

WARNING

Don't work soil that's too wet. Working soil that's too wet ruins the soil structure — after it dries, the soil is hard to work and even harder to grow roots in.

The easiest way to turn your soil, especially in large plots, is with a *rototiller* (or *tiller*, for short). You can rent or borrow a tiller, or if you're serious about this vegetable-garden business, buy one. Tillers with rear tines and power-driven wheels allow you to really lean into the machines and use your weight to till deeper. If you have a small (less than 100 square feet) vegetable plot, consider using a minitiller (see Chapter 1 for more details on this tool) or hand dig it if you're up for a little exercise. If you use a rototiller, adjust the tines so the initial pass over your soil is fairly shallow (a few inches deep). As the soil loosens, set the tines deeper with successive passes (crisscrossing at 90-degree angles) until the top 8 to 12 inches of soil are loosened.

To turn your soil by hand, use a straight spade and a digging fork. You can either dig your garden to one spade's depth, about 1 foot, or *double dig* (that is, work your soil to a greater depth), going down 20 to 24 inches. After turning the soil, level the area with a steel rake, breaking up clods and discarding any rocks. Although double digging takes more effort, it enables roots to penetrate deeper to find water and nutrients. If you're double digging, dig the upper part of the soil with a straight spade to remove the sod and loosen the *subsoil* (usually any soil below 8 to 12 inches) with a spade. Replace the original topsoil often when you loosen the subsoil.

WARNING

Don't overtill your soil. Tilling to mix amendments or loosen the soil in spring or fall is fine, but using the tiller repeatedly in summer to weed or turn beds ruins the soil structure and causes the organic matter (the good stuff) to break down too fast. In the case of tilling, more isn't necessarily better.

SAYING YES TO NO-TILL GARDENING

A large percentage of gardeners adhere to a strict no-till policy. A rototiller makes the work of mixing soil easier, but it also tends to destroy the soil structure — the intricate network of thousands upon thousands of particles of sand, silt, clay, and organic matter that make up your dirt. That structure determines the soil's capability to hold the water, nutrients, and air that your plants need to grow. The relentless machinery of a rototiller is devastatingly effective — maybe too effective — at breaking down that life-giving structure.

No-till gardening is increasing in popularity among gardeners looking to adopt more organic practices. Fewer amendments are needed to help build back the soil quality; no rototiller means no fossil fuel consumption and air pollution; and turning soil by hand allows the beneficial bacteria, fungi, micro-organisms, and earthworms in your soil to live and continue to do their important jobs.

Converting your garden to a true no-till garden can be a lengthy process that takes multiple seasons and lots of patience and discipline, but devotees say it results in a dramatically healthier garden with stronger plants and even far fewer weeds!

Looking Ahead at Watering Options

You can water your vegetable garden several different ways. This section discusses some of the basic techniques, from the simple — furrows and basins — to the more complicated — drip irrigation and harvesting systems.

It's a good idea to consider how you'll water your garden before you actually plant your garden. Some of these ideas are easier to plan for and implement when the beds are a blank canvas rather than work around tender young seedlings or maturing plants already in the ground.

TIP

You can measure water flow by attaching an inexpensive *flowmeter* (available at hardware and garden supply stores) to your outdoor spigot. To figure out the flow rate at the spigot, turn off all the spigots and read your water meter. Then turn on the spigot serving the hose line for 1 minute. Reread the meter to find out how much water flows through the hose in 1 minute. You need about 60 gallons per 100 square feet of garden to get 1 inch of water.

Furrows

Furrows are shallow trenches between raised beds that channel water to plant roots. This watering method is based on an old farmer technique of planting on narrow raised mounds or beds and then using furrows to water. The beds can be 1 to 3 feet apart — the wider apart they are, however, the more water you need to add. You can use a hoe to dig a furrow at planting time and then plant the seeds or transplants on top of the raised beds, in between the furrows.

When you're ready to water, fill the furrows completely with water and then wait a while, or fill them more than once so the water penetrates down as well as sideways into the raised soil. Poke around with your finger to make sure the water has penetrated the bed.

Furrows work best on level or slightly sloping ground; otherwise, the water moves too fast down the furrows without sinking in. This watering technique traditionally has been used in arid areas with clay soil, such as the Southwest, where little natural rain falls during the growing season and streams or ground water can be used in the garden. Furrows don't work well in sandy soil because the water soaks in before it can reach the end of the furrow.

WARNING

Furrows aren't the most efficient way to water. Here are a few reasons:

- It takes time for the water to run from one end of a mound or bed to the other.

- The beginning of a row always gets more water than the end.
- You have to move your hose around a lot to fill each furrow.
- Water is wasted through evaporation as it’s sitting in the furrow.

Basins

A *basin* is a donutlike depression around a vegetable plant that you fill with water — almost like a circular furrow. You make a basin in a 2-foot-diameter circle around the plant. Plastic basins that fit underneath plants such as tomatoes and eggplants are sold commercially. These basins concentrate the water around the roots of the plant.

WARNING

Homemade basins work particularly well for watering sprawling plants such as melons and squash early in the season. After the plants mature, however, their roots grow out of the diameter of the basin, and the method is no longer effective.

Hoses

Watering with a hose is probably the most common way that gardeners water. It’s simple, and some might say therapeutic. Who hasn’t seen a gardener after a long day at work come home and take some time to hose down the garden with a cup of coffee or drink in hand?

However, watering with a hose isn’t the ideal watering system and probably is best for watering containers; for watering individual, large plants such as tomatoes; and when used in conjunction with the basin method (explained in the preceding section). In these situations, you can be sure that you’re applying the right amount of water to your plants.

Unless you check the amount of water you’re applying by digging the soil after watering, you may not water your garden evenly with a hose. Some areas may have lots of water, whereas other areas may just have water on the surface. Also, like overhead sprinklers (described in the next section), a hose is a more wasteful way of watering because much of the water falls in pathways or on the lawn around your garden.

REMEMBER

The best way to water your vegetable garden with a hose is to leave the hose running at a trickle in a basin near each plant until the water has soaked down at least 6 inches deep.

Sprinklers

A sprinkler, shown in Figure 3-3, is effective for watering vegetables planted in sandy soil that absorbs water quickly. It's also an effective way to water a large garden when you're pressed for time. Just set up the sprinkler, and based on the amount of time it takes to water to 6 inches deep (see Chapter 5 in this minibook for details on knowing when your vegetables need a drink), you can set a timer and go about other business.

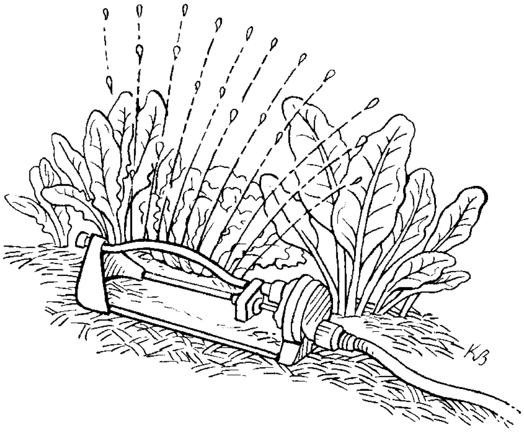


FIGURE 3-3: Watering with a sprinkler.

However, if you have heavy clay soil that absorbs water slowly or if your garden is on a slope, the water may run off and not sink into the soil where the plants need it. Instead, it's best to use drip irrigation (see the next section) so the water soaks into the ground.

For vegetable gardens, portable-type sprinklers (versus in-ground permanent sprinklers used in lawns) are best. You can move them around in your garden to cover a certain area or the whole garden. Some sprinklers throw water back and forth, whereas others send it in a circular direction. Choose the type that best suits your garden design.

TIP

Constantly wetting the foliage of vegetable plants can encourage disease problems. So when you use a sprinkler, water in the morning so the foliage can dry before nightfall and so you lose less water to evaporation.

As taller plants such as corn and tomatoes grow, sprinklers tend to be less effective because the water hits the foliage, damaging it and not thoroughly watering the rest of the garden. Some gardeners use watering towers that have an overhead sprinkler attached to the top. You position the sprinkler a few feet above the plants, hook it up to a hose, and sprinkle the garden. However, even these sprinklers prove to be less effective when plants reach above 4 to 5 feet tall. For these taller plants, it's best to choose one of the other watering methods described in this chapter.

WARNING

Frequent, shallow waterings do more harm than good. They cause roots to develop mainly in the upper few inches of the soil, where they're susceptible to drying out. Instead, go for occasional, deep waterings. Deep waterings allow moisture to penetrate deeply into the soil. The roots will follow the water, and the plant will be deep rooted and less likely to be affected by dry conditions. You'll water less frequently; maybe deeply once per week.

Soaker-hose irrigation

A *soaker-hose irrigation system* consists of a rubber hose perforated with tiny pores that leak water, as shown in Figure 3-4. You can lay the hose between rows or curve it around plants, similar to how you use a drip irrigation system (described in the following section). Water leaks out of the hose and onto the soil, leaving your plant foliage dry and reducing evaporation.

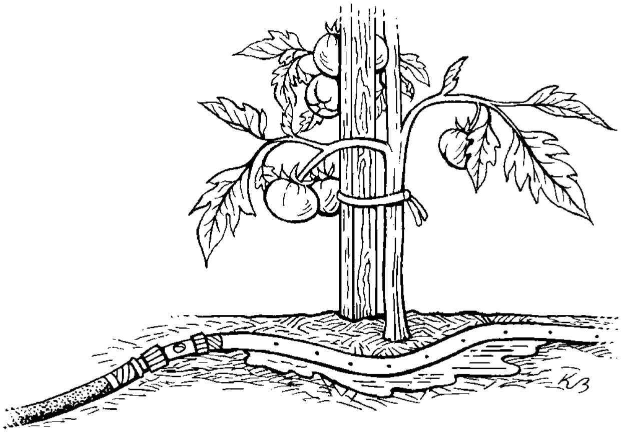


FIGURE 3-4: Watering with a soaker hose.

REMEMBER

Using a soaker-hose system is easier than using a drip irrigation system because it involves fewer parts and no nozzles. Its primary limitation is that it works best on flat terrain, often delivering water unevenly on sloped or bumpy gardens. It also may clog over time and not deliver water evenly along the hose.

Drip irrigation

A *drip irrigation system* provides water slowly through holes, or *emitters,* in flexible plastic pipes. Many different drip irrigation systems are available; they can consist of a single pipe with flexible lines running off it, or a series of pipes. You weave these pipes — which are connected to a water supply, a filter, and often a pressure regulator — along rows of plants so the water flows directly to the roots of your vegetables, as shown in Figure 3-5.

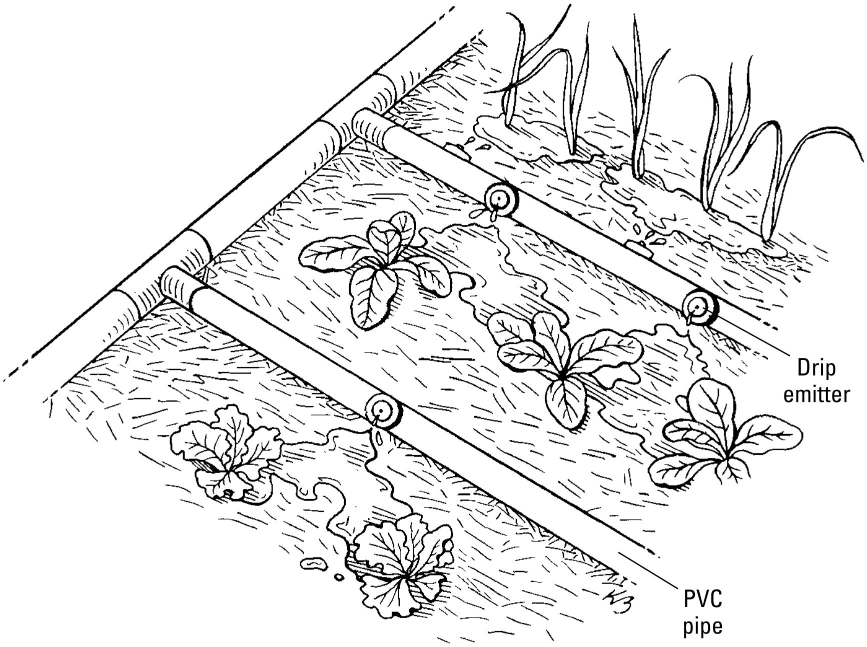


FIGURE 3-5: Watering with drip irrigation.

This watering technique is the most effective and efficient way to water vegetables because water drips right to the roots of the plants and little water is wasted on pathways, in between plants, and in between rows. Drip irrigation works well even if your garden is on a slope, which poses problems for most other systems.

WARNING

The downside to drip irrigation is that it's more costly than the other methods listed in this chapter; it's also more involved to set up and take down at the end of the season. Drip irrigation is best for those gardeners who are into technology, who don't have lots of time to water, and who live in water-restricted areas.

You can wet an entire bed from one end to the other at each watering with drip emitters. You snap the emitters in the pipes wherever you want them, or you can buy a pipe with emitters already evenly spaced along the length of the pipe. The moisture radiates sideways underground and wets the soil between emitters.

TIP

As an alternative to emitters, you may want to use *microsprinklers,* which are tiny sprinklers that hook to plastic pipes like drip emitters. They're usually supported by 12- to 24-inch stakes and cover various-sized areas of soil with a fine spray of water. They're particularly useful for watering closely spaced vegetables such as lettuce and root crops, or for watering germinating seeds.

Most nurseries sell drip irrigation systems, but you also can purchase them online. Emitters and microsprinklers are available with different application rates, varying by the number of gallons applied per hour. Pressure-compensating emitters apply water consistently from one end of the line to the other, regardless of pressure changes due to uneven ground.

Follow these steps to set up a drip irrigation system in your garden:

1. **Lay the pipe (or pipes — depending on the system) on top of the soil and cover the pipe with plastic mulch, or bury the pipe a few inches below the surface of the soil.**

   Most people like to keep the pipe close to the surface so they can check it for clogs and fix breaks.

2. **If your pipe doesn't already have emitters in it, snap emitters in the pipe wherever you want them.**

   Position the emitters so they're close to the bases of your plants.

3. **Run the drip system for at least several hours a day (two to four hours).**

   Watch the system carefully the first few times that you water. Dig around in your garden to see how far the water travels over a given time period, and then adjust your watering schedule in the future.

WARNING

If you live in an area where the soil freezes, don't leave your drip irrigation system or soaker hoses outside in the winter because they may burst. Instead, drain the water out, roll up the tubing, and store it in your garage.

Harvesting rainwater in a barrel

One of the simplest ways to collect water is by installing a rain barrel under a downspout of your gutters (see Figure 3-6). This method is safe, easy, and quite productive. For example, ½ inch of rain hitting a 1,000 square foot roof will yield more than 300 gallons of water. Commercial rain barrels are attractive, too. Some look like old whiskey barrels, while others are shaped like giant urns. They can be nice additions to your yard. Here's what you'll need to get started:

- **Gutters:** It's clear you'll need gutters on part of your roof to collect the rain water hitting it. Although a cost investment at first, they will pay for themselves in water savings later on. Ideally, place the downspout so that it connects to the gutters on that side of the roof closest to the garden.

- **Barrels and cisterns:** Although a simple 60-gallon rain barrel is great for collecting water, sometimes you might get hundreds of gallons of rain in a single day! It's hard to just let that water go to waste, especially if you're gardening in a dry climate. You can connect a few barrels together to save more water or use a cistern. Cisterns are large above or below ground vessels that hold hundreds of gallons of water. They may not be practical for the average urban homeowner, but are something to consider when building or buying a home in a dry climate.
- **Screens:** Water coming off the roof collects leaves, pine needles, and other debris. Place a heavy-duty, removable screen at the end of the downspout to catch these materials before they enter the barrel. This will prevent clogging the outflow spigots in the rain barrel. Clean them out periodically to allow the water to flow through.
- **Hoses:** After you have all the pieces in place, you'll need a way to get the water to the garden. You could simply dip your watering can in the barrel and hand water. Also, many commercial rain barrels have spigots where you can attach a hose and run it to the garden. As long as the barrel is higher than the garden, gravity will feed the water through the hose and onto your plants.

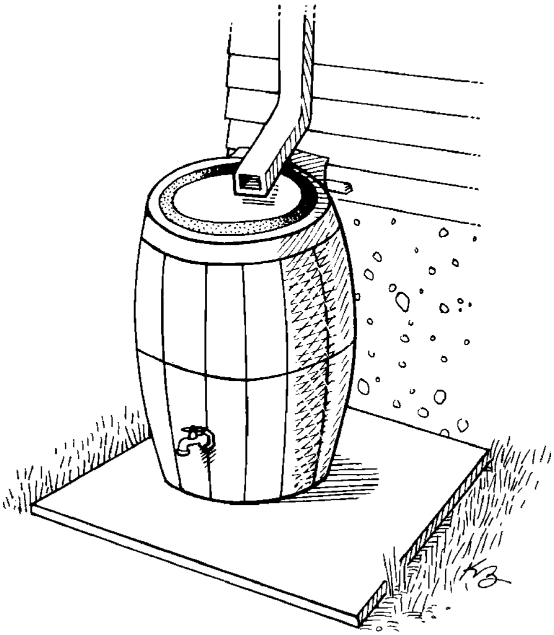


FIGURE 3-6: A rain barrel.

Illustration by Kathryn Born

THE BLACK AND WHITE OF GRAYWATER SYSTEMS

One way to harvest and re-use water that has seen a recent uptick in popularity is the installation of a graywater system. A *graywater system* uses secondhand water from your washing machine, sinks, and possibly tubs and showers (never toilets). The water is collected with a system of pipes throughout the house and delivered to landscape plantings, often after being stored temporarily in an underground cistern. If graywater irrigation is legal where you live (it isn't everywhere), it can be a great way to recycle water in certain areas of the landscape. Although you can irrigate ornamentals and even fruit trees with graywater, health reasons prohibit its use on vegetables or other edible crops. Even though experts claim that there are no documented cases of anyone becoming sick from contact with graywater, you shouldn't ignore the possible health risks. Because of the potential for problems, graywater can't be allowed to appear on the surface of the ground and can't be applied through overhead sprinklers or garden hoses. Homesteaders may love the repurposing concept of a graywater system, but it's simply not compatible with crops you'll be harvesting to eat.

Fencing It In

Your property needs boundaries around it and pathways within it. Even sprawling ranches under the western sky have fences around them and a dusty road or two through the sagebrush. In your backyard homestead, fences and walls define areas. For many homesteaders, it's helpful to have the chickens' part of the yard partitioned off from, say, the vegetable garden. Fences can help you form a basic infrastructure. Installing them (or at least planning for them) early in the process of creating a homestead — before things are planted or your animals are scurrying about — can be a logistical lifesaver.

Most fences are variations on a basic design: posts buried in the ground; horizontal rails installed between them; and some kind of fencing attached to the rails — pickets, boards attached vertically, boards attached horizontally, lattice, wire mesh, solid panels, siding materials, bamboo, or wood worked into decorative designs.

Six feet is standard for side and back yards, but may not be high enough if you have a raised deck or if neighboring houses are close to your property line. You may have to build an 8-foot fence (check your local zoning laws first, though) or solid screen of tall bushes. For front-yard fences, 3 to 4 feet is sufficient for defining your property line. Short fences are also usually adequate for sectioning off just a portion of your homestead. If you have a corner lot with fences along both streets, make sure that neither fence blocks views of traffic. Check your local zoning ordinances for other restrictions, and be sure to discuss the fence with your neighbor.

TIP

If deer are a concern in your area, your garden beds could become a giant salad bar for Bambi. A fence meant to keep deer out needs to be 8 feet tall. Or angled strategically. Or electrified. Or even paired with a second fence. Check out Chapter 1 of this minibook for more tips to help keep unwanted critters out of your homestead.

Building the fence

If you have a few weekends, some vacation time, or lots of helpers in the family, you may enjoy building your own fence. The experience offers an excellent opportunity to practice basic carpentry skills. For a basic wood fence, follow the steps in this section.

Laying out post hole locations

Start by laying out the locations for your post hole:

1. **Stretch a string along the fence line.**

   Align it with the centers — not the edges — of the post positions.

2. **Establish the post spacing.**

   Posts are typically spaced 5 to 8 feet apart, depending on the size of framing members, weight of the fencing material, and length of prefabricated fence panels, if you use them. If possible, choose a spacing that divides evenly into the total fence length.

   TIP

   Don't forget to put in posts for the gate. Try to make fence *bays* (sections between posts) equal on either side of the gate. If you end up with an odd-sized bay, get rid of it by readjusting the post spacing or changing the overall fence length. If neither solution works, split the odd-sized bay dimension in half and place the shorter bays at each end of the fence.

3. **Mark the ground.**

   Starting at the uphill end of the fence and holding a tape measure as close to level as possible (rather than laying it on sloping ground), mark the center of each post location with spray paint, a swatch of cloth with a nail through the center, or a pinch of flour. To align the mark with the stringline, hold a *plumb bob* (a string with a weight on the end) against the string or hold a level vertically against it, without deflecting the string.

Installing posts

Use the following instructions, shown in Figure 3-7, to install the posts.

1. **Temporarily move the stringline out of the way.**
2. **Determine post hole size.**

   Plan 12-inch diameter holes for 4x4 posts set in concrete; 8-inch diameter for posts set in alternating layers of gravel and earth (a technique used in regions with severe winters and firm soils). If you use larger posts, expand the hole accordingly.

   The hole depth should be equal to ⅓ the fence height, plus 6 inches for a layer of gravel at the bottom of the hole. A 6-foot (72-inch) fence, for example, requires a 30-inch hole — 24 inches for the buried portion of the post, plus 6 inches for gravel. Add another 12 inches (for a hole that's 42 inches deep) for gate posts and corner posts.

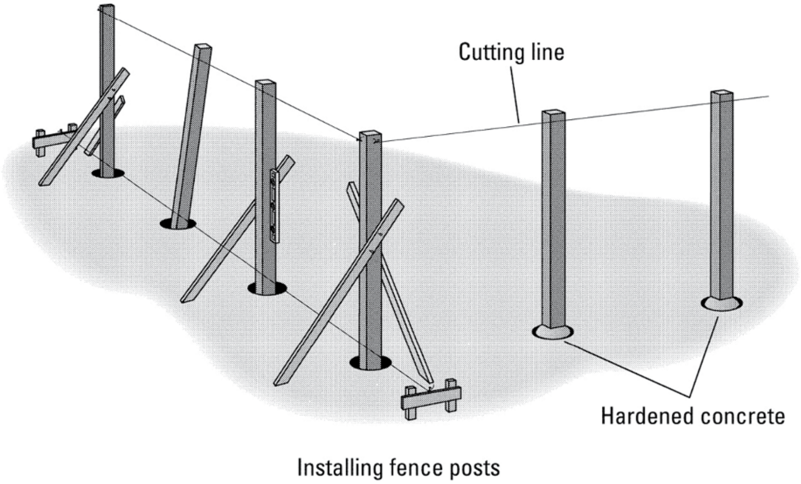


FIGURE 3-7: Use stringlines to align fence posts and mark them for trimming.

3. **Dig holes.**

   No way around it, this is hard work. For just a few holes, use a *clamshell digger* (hand tool that resembles a large pair of tongs). For long fences, rent a *power auger* (a gas-powered, hand-held machine with a screw-type blade) or hire an excavator. If you rent an auger, specify an 8-, 12-, or 14-inch diameter blade. Whichever tool you use, have a 6-foot long digging bar handy to dislodge rocks and loosen hard soil. Keep the sides of each hole plumb — don't flare the top of the hole; if anything, flare the bottom to increase stability.

WARNING

A power auger generates tremendous *torque* (twisting force) and requires two strong people to operate the beast, especially one with a large-diameter blade.

4. **Place 6 inches of gravel or crushed rock in the bottom of each hole.**
5. **Restring lines.**

   Move the stringline position from the post centers to the post edges (either side). For 4x4 posts, for example, move the stringline over 2 inches (1¾ inches if you use *surfaced* (that is, planed or smooth) posts, which are 3½ inches thick).

6. **Set the corner or end posts in place first.**

   Set each one in its hole, burying the bottom 2 inches in the gravel. Align the post with the stringline(s), using a level to make sure that the post is plumb. Brace the post by driving stakes diagonally into the ground along two adjacent sides. Nail the stakes to the post with duplex nails — 8d nails for 1-by stakes; 16d for 2-by stakes, again checking with a level to make sure the post is plumb.

   TIP

   If the posts aren't pressure-treated with preservatives for ground contact, apply preservative to the portion that will be buried by soaking the end of each post in preservative. Use a brush to reach undipped areas.

7. **String a line between the end posts near the top.**
8. **Set the remaining posts in their holes.**

   Align them to both stringlines and brace them, using a level to make sure they're plumb.

9. **Backfill the holes.**

   If you use concrete, mix enough for one or two holes at a time. Shovel the concrete carefully around each post and jab a stick or metal rod into the concrete several times to consolidate it. Using a trowel or shovel, mound the top of the concrete to keep water from settling around the post.

   If you backfill with alternating layers of gravel and soil, pack each layer firmly to a 2- or 3-inch thickness, using a pipe or rod. Mound the top layer of soil to shed water away from the post.

TIP

Posts with *mortises* (holes) cut into them to receive rails, or with decorative tops, must all be set to the same level — you can't trim the tops to level them. To do this, install the higher end post first. Attach temporary *cleats* (short pieces of wood that straddle the hole) to opposite sides of the post to keep it from sinking into the hole. Install the other end post at the same level, using a water level or builder's level to keep them aligned. Brace both posts securely. Then, measure down an equal distance from the top of each post, tack nails at those points, and stretch a line between the nails. Install the remaining posts so that all of the tops are an equal distance above the stringline.

Building the framework

To build a framework for your fence, follow these steps (see Figure 3-8):

1. **Trim the post tops.**

   After the concrete sets, mark and trim the tops of the posts so that they are all level. If the ground is fairly level, simply start with the post at the highest point of the fence. Mark that post where the top rail rests on top of the post. Using a string level, transfer this mark to the other end post. String a *chalkline* (a string coated with chalk) between the two marks and snap the line to transfer chalk marks to the other posts at the same level. Using a square and pencil, extend the mark around the four sides of each post. Cut along these marks.

   If the ground slopes gently, take trial measurements at several posts and refer to your plans to determine the best level for cutting. If the ground slopes steeply, step the fence down the slope by marking only a few posts level with each other and then lowering the marking level a few inches for the next few posts, and so on.

WARNING

Making horizontal cuts with a circular power saw is dangerous. If you don't have experience making such cuts, use a handsaw. If you do have experience, stand on a sturdy stepladder or bench, and wear safety glasses.

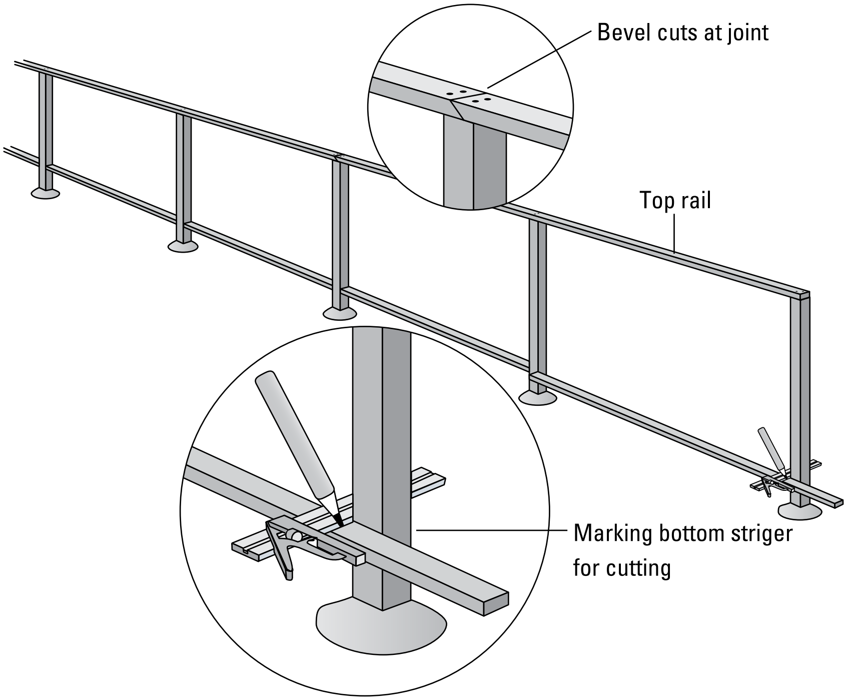


FIGURE 3-8: After the concrete hardens, attach the fence rails to the posts.

2. **Install the top rail.**

   Use 2x4s or 2x6s long enough to connect at least three posts. Take measurements, along a level line, at the *bottoms* of posts (the tops may be out of line). Plan joints over the centers of posts. After cutting each board, secure it to each post with at least two 16d galvanized spiral-shank nails — drill pilot holes for nailing near the ends of boards. You may need to pull post tops into alignment before nailing.

   TIP

   As boards shrink, joints open up. When joining boards end-to-end, cut the ends at a 30-degree *bevel* (angle, as viewed from the edge — refer to Figure 5-2) so that each board slightly overlaps the previous board. As the joint opens up, the beveled ends appear to touch each other from most viewing angles.

3. **Install bottom rails between the posts.**

   Mark the rail locations on each post by measuring *down* from the top rail (which should be level), not up from the ground. Cut 2x4s to fit between the posts at these marks. Install them by drilling pilot holes and toenailing each end to the post with two 16d galvanized spiral-shank nails.

4. **Install kickboards.**

   To fill the gaps below bottom rails and make the fence stronger, install a 1-by board, set on edge, under each bottom rail, as shown in Figure 3-9. Cut it to fit between the posts. If it's too wide for the gap, excavate some soil or trim the bottom of the board to the same contour as the ground. Toenail it to the posts with 8d galvanized common nails (drill pilot holes first).

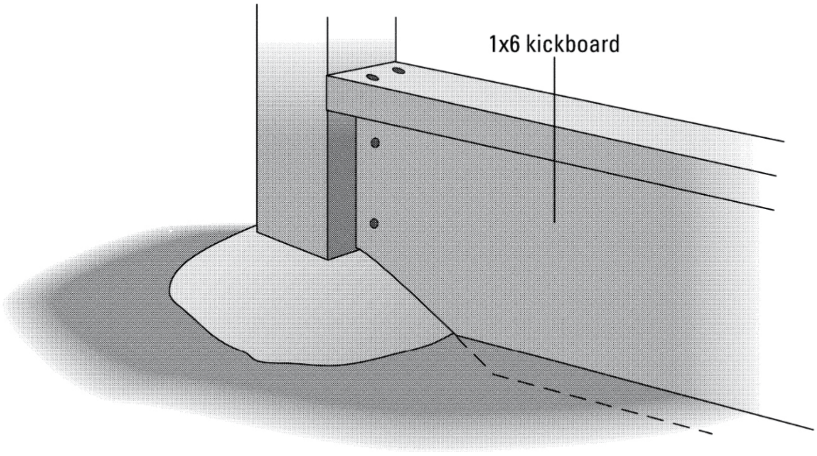


FIGURE 3-9: A kickboard secures the bottom of the fence and is relatively easy to replace if the wood rots.

Installing the fencing

With the basic framework of the fence in place, you can now finish it with the individual boards or panels that provide separation and privacy in and around your homestead:

1. **Install nailers, as needed.**

   If you install boards or panels between the rails, you may need to attach *nailers* (strips of wood) along the bottom of the top rail and top of the bottom rail to nail the fencing to — and perhaps along the posts, as well.

   WARNING

   Avoid a fence design that depends on too many nailers. They create more joints for moisture to get trapped in — which encourages rot — and provide weaker support than the frame itself.

2. **Attach the boards or panels to the framework or nailers.**

   Attach 1-by boards with 8d galvanized box nails. Attach lattice screening with galvanized deck screws.

   For pickets or other vertical boards with uniform spacing, make a spacer to speed up installation — see Figure 3-10. *Rip* (saw along the board's length) a board to the same width as the required spacing, long enough to extend from top rail to bottom rail. Attach a small cleat to the back side of the spacer, flush with the top edge, as a hanger. After installing each board, hang the spacer beside it, butt the next board against the spacer, and nail the board in place. Use a straightedge or stringline to keep the tops level.

   TIP

   Rent a pneumatic nailer to speed up installation of the fencing. The rental agency provides operating and safety instructions.

3. **Trim the top edge.**

   If you attach boards to the edge of the rails (rather than below the top rail), the tops may not be even (unless you used a straightedge or stringline to keep them level, as with a picket fence). Snap a chalkline along the length of the fence (shown in Figure 3-11), at the finished height, and cut along the line. If you use a power saw, nail a cleat along the fence to guide the saw.

4. **Add decorative trim.**

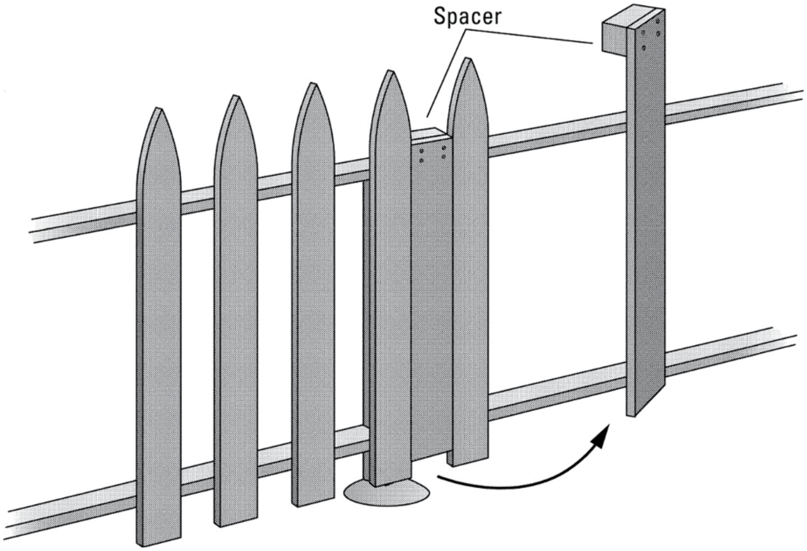


FIGURE 3-10: Installing pickets is less tedious if you use a spacer to align each picket.

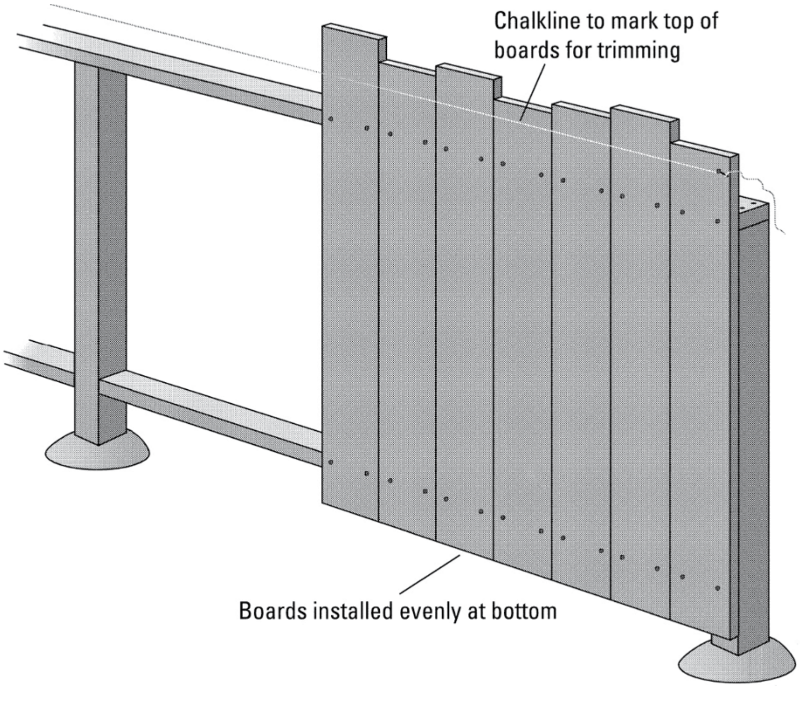

Chalkline to mark top of boards for trimming
Boards installed evenly at bottom

FIGURE 3-11: For a simple board fence (not pickets), trim the top of the fence after installing all of the boards.

Applying the finish

Allow the wood to season for a week or two and apply a sealer (for natural color) or water-repellent stain to the fence. If you paint the fence, wait several weeks for the wood to season. Apply white-pigmented shellac to exposed knots to keep resin from bleeding through the paint. Then prime the fence (use oil-based primer for redwood and cedar, or latex for other woods) and finish it with one or two coats of latex paint.

Planning for Pathways

After you have the boundaries of your homestead and the areas within it established with fences, think about how you'll move throughout the property. Pathways connect the various areas within your homestead with one another and make it easier to get from Point A to Point B. Base them on where you need to walk, but also allow them to meander slightly to take advantage of views and attractive garden settings; you do want to enjoy the time you spend in your homestead, too! (Avoid low areas with poor drainage and steep inclines, though.)

Make paths at least 36 inches wide; two people walking side-by-side require a 48-inch width. Also consider the pathways that will see a lot of back-and-forth traffic from wheelbarrows and garden carts. As far as the pathway's walking surface, consider stepping stones, gravel, crushed stone, or good old wood chips. Know that you'll need to replenish them once or twice a year.

IN THIS CHAPTER

- **Knowing when to plant certain crops for best results**
- **Deciding between seeds or transplants for your garden**
- **Starting seeds indoors and moving them to the garden when it's time**
- **Sowing seeds directly in your garden beds**

Chapter 4

Planting

Are you ready to plant some vegetables? Now the fun really starts. You can plant vegetables two different ways — from seed or by transplant:

- When planting seeds, you either sow the seeds indoors and then transplant the young seedlings in your garden (when the time is right, of course), or you sow the seeds directly in your garden.
- To skip the seed process, you purchase young *transplants* (seedlings ready to be transplanted) at your local nursery or through the mail and then plant them directly into your garden.

Both methods have their advantages, and timing is critical to success. You can plant seeds quickly and without much thought. But working deliberately and carefully — whether planting indoors or out — pays off in sturdier, more vigorous plants. This chapter guides you through the planting process and gives you information about correct seed spacing, planting depth, soil and germinating conditions, and fertilizing so you produce strong-growing, vigorous plants. It also covers how to plant transplants, whether you grow them yourself or buy them.

Timing Your Planting Wisely

As the saying goes, "Timing is everything." This axiom is especially important for vegetable gardening, so file it where you can't forget it. Remembering it will save you lots of heartache and disappointment. For example, if you plant tomatoes too early, the plants will sit there like bumps on a log, not growing and possibly rotting in cold, wet soil or turning mushy and black after they've been zapped by frost. Plant lettuce too late, and it'll produce more flowers than leaves, and the leaves you harvest will be tough and bitter. There are examples like this for every vegetable; just know that planting at the wrong time of year is a recipe for disaster.

If you follow the rhythms of nature and plant when conditions are perfect for proper growth, growing vegetables is a breeze. But how are you supposed to know about these rhythms? Start tapping your foot, because the following sections will have you moving like Fred Astaire.

Some like it cool, some like it hot

Vegetables can be divided into the following two categories based on the temperature conditions in which they grow best:

- **Cool-season vegetables:** These vegetables, such as lettuce, spinach, peas, potatoes, broccoli, and cabbage, grow best in the cool weather of spring and fall. As vegetables go, they're fairly hardy and survive despite freezing temperatures. In most areas, cool-season vegetables are usually planted in early spring so they mature before the onset of hot weather, or in late summer to early fall for maturation in the cool months of fall or early winter. However, in areas where summers are very cool and winters are mild, such as in coastal areas of the western United States and the far north, cool season vegetables can be grown year-round and may be the only vegetables that can thrive in this climate.

  WARNING

  What happens if you plant a cool-season vegetable when it's too warm? Not a lot of good. Lettuce will *bolt,* meaning it starts to flower before you get a chance to harvest it. In other words, instead of producing tender, crisp leaves, lettuce will send out a tall flower spike. Any leaves that are left on the plant will be bitter-tasting and tough. Broccoli will form loose clusters of yellow flowers instead of forming nice tight heads. And peas won't properly fill their pods with sweet, succulent peas. You get the idea!

- **Warm-season vegetables:** These vegetables, such as beans, tomatoes, peppers, cucumbers, melons, squash, okra, and corn, like it hot and grow best in the warm months of summer. They need warm soil and air temperatures to grow their best; if they're planted while the weather is still too cool, they'll suffer and not grow. Because freezing temperatures kill these vegetables, they're usually planted after the threat of frost in spring. In warm areas, they also can be planted in late summer for a fall harvest.

To push along warm-season veggies, wait until the soil and air are the proper temperature. Or consider using season extenders to trap heat around the plants. Season extenders also help in cool summer climates such as the Pacific Northwest, where the weather rarely gets warm enough even in summer to ripen heat-loving vegetables such as melons. (Chapter 7 of this minibook has more ideas on season-extending techniques.)

Frost dates and the length of the growing season

You should know two important weather dates for your area if you want to grow vegetables successfully:

- The average date of the last frost in spring
- The average date of the first frost in fall

These frost dates tell you several important things:

- **When to plant:** Cool-season vegetables are generally planted four to six weeks before the last spring frost. Fall planting of cool-season vegetables is less dependent on frost dates, but it's usually done eight to twelve weeks before the first fall frost. Warm-season vegetables are planted after the last spring frost or in late summer in warm areas for a fall harvest.
- **When to protect warm-season vegetables:** Frosts kill warm-season vegetables. So the closer you plant to the last frost of spring, the more important it is to protect plants. And as the fall frost gets closer, so does the end of your summer vegetable season — unless, of course, you protect your plants. See how to provide frost protection in Chapter 7 of this minibook.
- **The length of your growing season:** Your *growing season* is the number of days between the average date of the last frost in spring and the average date of the first frost in fall. The length of the growing season can range from less than 100 days in northern or cold winter climates to 365 days in frost-free southern climes. Many warm-season vegetables need long, warm growing seasons to properly mature, so they're difficult, if not impossible, to grow where growing seasons are short.

  How are you to know whether your growing season is long enough? If you check mail-order seed catalogs or even individual seed packets, each variety will have the number of days to harvest or days to maturity (usually posted in parentheses next to the variety name). This number tells you how many days it takes for that vegetable to grow from seed (or transplant) to harvest. If your growing season is only 100 days long and you want to grow a melon or other warm-season vegetable that takes 120 frost-free days to mature, you have a problem. The plant will probably be killed by frost before the fruit is mature. In areas with short growing seasons, it's usually best to go with early ripening varieties (which have the shortest number of days to harvest).

TIP

However, you also can find many effective ways to extend your growing season, such as starting seeds indoors or planting under *floating row covers* (blanketlike materials that drape over plants, creating warm, greenhouselike conditions underneath). Various methods of extending growing seasons are covered in Chapter 7 of this minibook.

There you have it; now you know why frost dates are so important. But how do you find out dates for your area? Easy. Ask a local nursery worker or contact your local Cooperative Extension office (look in the phone book under *county government*). You also can check Table 4-1, which lists frost dates for major cities around the country. Double-check online sources due to continuing climate changes.

TABLE 4-1 First and Last Frost Dates

City	Last Frost Date	First Frost Date	Length of Season
Birmingham, Alabama	March 29	November 6	221 days
Mobile, Alabama	February 27	November 26	272 days
Juneau, Alaska	May 16	September 26	133 days
Flagstaff, Arizona	June 13	September 21	99 days
Phoenix, Arizona	February 5	December 15	308 days
Tucson, Arizona	February 28	November 29	273 days
Fayetteville, Arkansas	April 21	October 17	179 days
Little Rock, Arkansas	March 23	November 9	230 days
Fresno, California	February 22	November 25	273 days
Los Angeles, California	None likely	None likely	365 days
San Bernardino, California	February 23	December 8	294 days
San Francisco, California	January 8	January 5	362 days
Sacramento, California	February 14	December 1	287 days
San Jose, California	January 22	December 25	338 days

City	Last Frost Date	First Frost Date	Length of Season
San Diego, California	None	None	365 days
Santa Rosa, California	March 26	November 19	236 days
Denver, Colorado	May 3	October 8	157 days
Durango, Colorado	June 4	September 18	105 days
Hartford, Connecticut	April 25	October 10	167 days
New Haven, Connecticut	April 15	October 27	195 days
Dover, Delaware	April 9	October 28	202 days
Wilmington, Delaware	April 13	October 29	198 days
Washington, DC	April 10	October 31	203 days
Jacksonville, Florida	February 14	December 14	303 days
Miami, Florida	None	None	365 days
Orlando, Florida	January 31	December 17	320 days
Tallahassee, Florida	March 12	November 14	246 days
Atlanta, Georgia	March 13	November 12	243 days
Savannah, Georgia	March 10	November 15	250 days
Boise, Idaho	May 8	October 9	153 days
Pocatello, Idaho	May 20	September 20	122 days
Chicago, Illinois	April 14	November 2	201 days
Indianapolis, Indiana	April 18	October 22	186 days
Cedar Rapids, Iowa	April 29	October 7	161 days
Des Moines, Iowa	April 19	October 17	180 days
Manhattan, Kansas	April 23	October 16	176 days
Wichita, Kansas	April 13	October 23	193 days
Lexington, Kentucky	April 17	October 25	190 days
Louisville, Kentucky	April 1	November 7	220 days
New Orleans, Louisiana	February 20	December 5	288 days
Portland, Maine	May 10	September 30	143 days
Baltimore, Maryland	March 26	November 13	231 days
Amherst, Massachusetts	May 9	September 29	142 days

(continued)

TABLE 4-1 ***(continued)***

City	Last Frost Date	First Frost Date	Length of Season
Boston, Massachusetts	April 6	November 10	217 days
Detroit, Michigan	April 24	October 22	181 days
Marquette, Michigan	May 12	October 19	159 days
Minneapolis–St. Paul, Minnesota	April 30	October 13	166 days
Duluth, Minnesota	May 21	September 21	122 days
Columbus, Mississippi	March 27	October 29	215 days
Jackson, Mississippi	March 17	November 9	236 days
Jefferson City, Missouri	April 26	October 16	173 days
St. Louis, Missouri	April 3	November 6	217 days
Billings, Montana	May 12	September 23	133 days
Helena, Montana	May 18	September 18	122 days
Lincoln, Nebraska	March 13	November 13	180 days
North Platte, Nebraska	May 11	September 24	136 days
Las Vegas, Nevada	March 7	November 21	259 days
Concord, New Hampshire	May 23	September 22	121 days
Newark, New Jersey	April 4	November 10	219 days
Trenton, New Jersey	April 6	November 7	214 days
Albuquerque, New Mexico	April 16	October 29	196 days
Los Alamos, New Mexico	May 8	October 13	157 days
Albany, New York	May 7	September 29	144 days
New York, New York	April 1	November 11	223 days
Rochester, New York	May 3	October 15	164 days
Syracuse, New York	April 28	October 16	170 days
Asheville, North Carolina	April 10	October 24	195 days
Charlotte, North Carolina	March 21	November 15	239 days
Raleigh, North Carolina	April 11	October 27	198 days
Fargo, North Dakota	May 13	September 27	137 days
Akron, Ohio	May 3	October 18	168 days

City	Last Frost Date	First Frost Date	Length of Season
Cincinnati, Ohio	April 14	October 27	195 days
Columbus, Ohio	April 26	October 17	173 days
Oklahoma City, Oklahoma	March 28	November 7	224 days
Tulsa, Oklahoma	March 30	November 4	218 days
Ashland, Oregon	May 13	October 12	152 days
Pendleton, Oregon	April 15	October 21	188 days
Portland, Oregon	April 3	November 7	217 days
Allentown, Pennsylvania	April 21	October 18	179 days
Pittsburgh, Pennsylvania	April 16	November 3	201 days
State College, Pennsylvania	April 27	October 15	170 days
Kingston, Rhode Island	May 8	September 30	144 days
Charleston, South Carolina	March 11	November 20	253 days
Columbia, South Carolina	April 4	November 2	211 days
Memphis, Tennessee	March 23	November 7	228 days
Nashville, Tennessee	April 5	October 29	207 days
Amarillo, Texas	April 14	October 29	197 days
Dallas, Texas	March 18	November 12	239 days
Houston, Texas	February 4	December 10	309 days
Cedar City, Utah	May 20	October 2	134 days
Salt Lake City, Utah	April 12	November 1	203 days
Burlington, Vermont	May 11	October 1	142 days
Norfolk, Virginia	March 23	November 17	239 days
Richmond, Virginia	April 10	October 26	198 days
Seattle, Washington	March 24	November 11	232 days
Spokane, Washington	May 4	October 5	153 days
Parkersburg, West Virginia	April 25	October 18	175 days
Green Bay, Wisconsin	May 12	October 2	143 days
Milwaukee, Wisconsin	May 5	October 9	156 days
Cheyenne, Wyoming	May 20	September 27	130 days

REMEMBER

Frost dates are important, but you also have to take them with a grain of salt. After all, these dates are averages, meaning that half the time the frost will actually come earlier than the average date and half the time it will occur later. You also should know that frost dates are usually given for large areas, such as your city or county. If you live in a cold spot in the bottom of a valley, frosts may come days earlier in fall and days later in spring. Similarly, if you live in a warm spot or you garden in a microclimate, your frost may come later in fall and stop earlier in spring. You're sure to find out all about your area as you become a more seasoned vegetable gardener and unearth the nuances of your own yard. One thing you'll discover for sure is that you can't predict the weather.

Listening to your evening weather forecast is one of the best ways to find out whether frosts are expected in your area. But you also can do a little predicting yourself by going outside late in the evening and checking conditions. If the fall or early spring sky is clear and full of stars, and the wind is still, conditions are right for a frost. If you need to protect plants, do so at that time. Frost-protection techniques are covered in Chapter 7 of this minibook.

Choosing Seeds or Transplants

Whether you choose to grow vegetables from seeds or transplants, each planting method has its own advantages. Here are some advantages to starting from seed:

- **A wider choice of varieties:** Your local garden store or nursery may carry only three or four varieties of tomato transplants but offer a great selection of seeds. And mail-order seed catalogs offer hundreds of varieties of seeds and specialty types, such as organically grown seed.
- **Healthy plants:** You don't have to settle for plants that are *leggy* (tall, weak, spindly stems) or *root-bound* (roots crammed into a small pot) and that may have been hanging out at the nursery too long. Such plants usually don't get off to a fast start when you plant them in the ground. Also, when you start from seed, you don't have to worry about introducing any insects or diseases into your garden that may be lurking on nursery-grown transplants.
- **Reduced cost:** Especially if you have a large garden, starting from seed can save you some dough. A six-pack of seedlings may cost you $3.00, whereas for the same price you can buy a seed packet with 100 seeds.
- **A lot of fun:** The excitement of seeing those first seedlings push through the soil is something special. Two feet of snow may be on the ground outside, but by sowing seeds indoors, you can enjoy a little spring.

The advantages to growing seeds stack up pretty impressively. But planting nursery-grown transplants has a major benefit as well — convenience and immediate gratification. Growing plants from seeds takes time and diligence, but going with nursery transplants gives you an instant garden. And if you have problems with transplants, you can always buy more. If you have problems with the special seed varieties you started, it's usually too late to start them again indoors, so you're out of luck growing that variety that year.

REMEMBER

Growing seeds is like taking care of a new pet. You have to check on seeds every day, maybe several times a day, to make sure they're happy. Unless a reliable neighbor or friend can care for your seedlings, say goodbye to your winter trip to the Caribbean. Also, you have to think in advance of what you'll be growing and need to start indoors. In this harried world, it's often easier to decide a week or so before planting what vegetable varieties you need and to buy transplants than to plan months in advance to start seeds. Plus, you have to store unused seeds somewhere where you won't forget them next winter. A metal tin in a cool, dark part of the house is best.

After you consider the advantages of each planting method, you need to make sure that you time your planting for the most productive results. Keep reading for full details on starting veggies from seeds and growing veggies from transplants.

Deciding on Your Seeding Method and Decoding a Seed Packet

Suppose you decide to grow your veggies from seeds. Now what? You have another choice to make: Will you start your seeds indoors or outdoors? If you plant seeds indoors, you have to transplant them into your garden later. With *direct seeding*, you skip the indoor step and sow the seeds directly into your garden. Which option should you choose? Probably both, if you're serious about growing vegetables. But consider these points when making your choice:

TIP

- **Starting indoors gives you a jump on the growing season.** If you start at the right time (remember, timing is everything), you can have vigorous seedlings that are ready to go into the ground at the ideal time. In areas with short growing seasons, starting seedlings indoors really gives you a head start.

  The best candidates for an early start are plants that tolerate root disturbance and benefit from a jump on the season. These veggies include broccoli, Brussels sprouts, cabbage, cauliflower, celery, eggplant, leeks, lettuce, onions, peppers, and tomatoes. Another group of vegetables that have to be transplanted carefully but do benefit from an early start include cucumbers, melons, and squash.

- Seeds are easier to start indoors. You have more control indoors, enabling you to more easily provide the perfect conditions for hard-to-germinate or very small seeds. You can provide the ideal temperature, moisture, and fertility so your seedlings grow strong and sturdy.
- **Some vegetables don't like to be transplanted and are better sown directly in the ground.** These vegetables include many of the root crops, such as carrots, beets, turnips, and parsnips. They're cold-hardy vegetables, so you can direct seed them pretty early anyway. Crops such as corn, beans, and peas also are pretty finicky about transplanting and grow better when you sow them directly in the ground. (Sowing seeds outdoors is explored in detail later in this chapter.)

REMEMBER

No matter your decision, the seed packet you buy to start your vegetables indoors or to plant directly in the ground is loaded with useful information. You still want to use a good book (like this one!) to get all the nitty-gritty details, but much of the information you need to plant your seeds is right on the packet. Consider some things your seed packet can tell you:

- The name or description should indicate whether it's a hybrid or open-pollinated variety (see Chapter 2 of this minibook for more on understanding vegetable varieties) and whether the seed is treated with a fungicide.
- The description tells you the high points about the variety, including yields, disease resistance, and suggestions for use. Remember to read with a critical eye, because companies can make all varieties sound fabulous.
- Cultural information tells you information such as when to plant, days to germination, mature plant size, days to maturity, and plant spacing.
- The packing date tells you the year in which the seeds were packed. Always buy this year's seeds for best germination. Even though many 1- to two-year-old seeds will still grow well, you shouldn't be paying full price for them, and your results may not be optimal.

Starting Seeds Indoors

To start seeds indoors, all you need is a container, soil, seeds, moisture, warmth, and light. The timing may vary depending on the specific vegetable, but here are the basic steps for planting seeds indoors:

1. **Sow the seeds in containers filled with sterile soil (which garden centers call a *germinating mix*).**

   Keep the seeds in a warm place until *germination* (when the first shoots start to push through the soil).

2. **After the seeds germinate, move the seedlings to a well-lit location (preferably under lights).**

   While your seedlings are growing in their well-lit location, be sure to keep them moist.

3. **Thin crowded seedlings.**

   When the seedlings' heights are three times the diameter of your pot, transplant the seedlings to a larger container.

4. **Acclimate the seedlings to outdoor conditions.**

   Adapting your seedlings to the weather conditions in the great outdoors is called *hardening off.*

5. **Plant the seedlings in your garden.**

Here's a little more detail to help your seeds off to the best start possible.

Picking a pot to plant in

Any container that holds several inches of soil and that you can punch drainage holes in is suitable for growing seedlings. Several low-cost possibilities include milk cartons, paper or Styrofoam cups, cottage-cheese containers, and home-made wooden *flats,* which are shallow, wide, seedling trays. Flats enable you to start many seedlings in a small space, which is helpful when you water or move the plants. After you plant the seeds in the flats, the seedlings stay there until planting time.

Garden stores and most mail-order garden catalogs sell a wide variety of plastic, fiber, peat, and Styrofoam flats and containers that satisfy just about any budget. You can even purchase pots made out of cow manure. Yum. Figure 4-1 shows you some flats that you can buy, along with the appropriate lights.

WARNING

You can use individual peat pots for plants such as cucumbers, which don't like to have their roots disturbed during transplanting. Similarly, for gardeners who put a premium on convenience, premade growing cubes (compressed peat pots that expand when soaked in water) are a good idea. The idea behind a peat pot is that once planted (pot and all) in the garden, the plants' roots grow through the sides of the wet pot, and as the season progresses, the peat naturally breaks down and disappears. But in the real world, the peat sometimes doesn't break down. In the fall when you pull up your plants, the peat pots may still be intact and some roots constricted in the pots. If you still want to give peat pots and cubes a try, follow the guidelines in the later section "Making the big move to the ground."

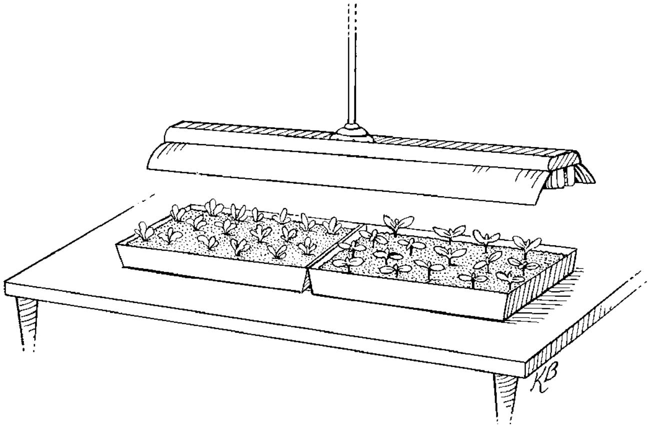


FIGURE 4-1: Seed-starting flats and lighting that plants love.

REMEMBER

Before you sow any seeds, sterilize your flats and pots (especially ones that you've used before) to prevent the fungus called *damping off* from killing your seedlings. (See the later sidebar "Dealing with damping off" for more on this soil-borne disease.) Dip the containers in a solution of 9 parts water to 1 part household bleach and then rinse them in clear running water.

Using a mix that doesn't include soil

The most practical seed-starting mediums for gardeners are the commercially prepared soilless or peatlite mixes that are sold in most garden stores as *potting soil* or *germinating mix.* As the name implies, the mix doesn't contain any true soil. Instead, it's usually a combination of peat moss, vermiculite or perlite, ground limestone (which brings the pH to proper levels, as discussed in Chapter 3 of this minibook), fertilizer, and sometimes compost, which is good for plant growth. Potting soil is lightweight, is free of disease organisms that may be present in true garden soil, and holds moisture well but at the same time offers good aeration and drainage.

WARNING

Don't use garden soil to start seeds indoors. Garden soil isn't light enough (that is, it doesn't have enough air spaces) and may contain insects or diseases that can kill your tender seedlings.

Sowing your seeds

After you've chosen the proper container and soilless soil (or *growing medium*), follow these steps to sow your seeds:

1. **Fill a container with moistened growing medium to within ½ inch of the top of the container.**

   Soilless mixes are dusty and difficult to wet initially. Pour the mix into a plastic bag, and then add enough warm water to moisten the mix but not turn it into a drippy mud pie. Mix the water and growing medium with your hands or a strong wooden spoon, closing off the opening of the bag as much as possible to keep the dust in. Remove the soil from the bag and place it in the container. Gently firm down the medium with a flat piece of wood, such as a ruler.

2. **If you're planting seeds in a flat, follow these directions to sow your seeds:**

   Make shallow *furrows* (rowlike impressions) with a blunt stick or by pressing the narrow edge of a ruler into the medium. Then sow the seeds according to these guidelines:

   - Sow small seeds, such as lettuce seed, at about five to eight seeds per inch if you intend to transplant them into different containers soon after they come up. Sow larger seeds, such as melons, at three to four seeds per inch.
   - Sow seeds more sparingly, at three to four seeds per inch, if you intend to thin and leave them in the same container (rather than transplant into a larger container).

   Either method — transplanting the seeds into a new container or leaving them in the same container — works fine; it's just a matter of what pots and room you have. Transplanting into individual pots takes up more room but allows larger plants such as tomatoes more room for their roots to grow. Smaller plants, such as lettuce, grow fine when thinned and left in their original containers.

   You can *broadcast* (randomly spread) seeds rather than plant them in rowlike trenches, but row planting and thinning are easier.

3. **If you're planting seeds in individual containers, here's how you sow:**

   - Put two to four seeds in each container.
   - Later, thin the seedlings, leaving the strongest one.

4. **After sowing the seeds at the correct depth (see the appendix), cover them with fine potting soil or vermiculite.**

   TIP

   Label each row or container because many seedlings look alike. You can purchase labels from a nursery or through a mail-order catalog, or you can use old ones from previously purchased nursery transplants. Using a waterproof pen, record the type of vegetable, the variety, and the date that the seed was planted.

5. **Water the seeds gently with a mister or spray bottle.**

   WARNING

   A stronger stream of water can wash seeds into one section of the container or move them too deeply into the soil.

6. **Cover the container with a sheet of clear plastic or a plastic bag to hold in the moisture.**

   If necessary, use small stakes to prop up the plastic so it doesn't rest on top of the soil.

7. **Place the planted containers in a warm spot.**

   The cooler the temperature, the longer it takes for the plants to emerge, so keep 'em warm and toasty! Some warm spots include the top of your refrigerator or near your furnace. But be careful how you water around electrical appliances. You also can buy heating cables or mats that keep the soil warm from below. Follow the package instructions carefully.

   WARNING

   Never put containers in direct sun; the plastic cover holds in the heat, cooking your seeds to death.

8. **Check the containers daily to make sure they're still moist but not so wet that they mold.**

   If you see signs of mold, loosen the cover and let air in; the mold should disappear. You also can hook up a small fan to gently blow across the seedlings (without the plastic cover on), keeping the soil on the dry side. However, be careful not to dry out the seedlings.

9. **As soon as you see the first green shoots emerge, remove the plastic cover and move your seedlings to a spot that provides plenty of light and the proper growing conditions for that vegetable.**

   Until seedlings emerge from the soil, light is unnecessary, with the exception of lettuce and celery seeds. Sow these seeds by lightly pressing them into the soil or covering them very lightly with ⅛ inch of fine potting soil, and then place the containers in a bright spot or position them under a 40-watt incandescent light.

Providing the right amount of light and heat

The light that your young seedlings receive is one of the most important factors in good growth. Placing the seedlings in a south-facing window is one option but not always the best one. Even in a sunny window, plants get only a fraction of the light that they would get outside. Windowsill plants often get tall and spindly because they get too warm in relation to the light they receive.

REMEMBER

Try to keep your seedlings on the cool side — 60 to 65 degrees Fahrenheit (75 degrees maximum) — to encourage slower growth; cooler temperatures give you sturdy, stocky plants that transplant well. Although a 10- to 15-degree drop in temperature at night is beneficial, a windowsill can get pretty chilly at night when it's wintry outside. Place a blanket between the plants and the glass to keep windowsill seedlings warm on frosty nights, or move plants away from the window at night.

Growing seedlings under fluorescent lights is a good way to keep light-hungry plants happy. Ordinary cool-white, 40-watt fluorescent bulbs are fine for starting seedlings. If possible, set up your lights near a window so the plants can receive both natural and artificial light. The more expensive grow lights that you can purchase at a nursery or through a mail-order seed catalog produce the broader spectrum light that plants need for flowering and fruiting (although your seedlings will be in the garden before they're ready to flower).

TIP

No matter what kind of light you have, use one set of lights (usually two bulbs to a set) for every 1-foot-width of seedling-growing area and keep the bulbs 2 to 4 inches from the tops of the seedlings at all times. Keep the lights on for no more than 16 hours per day so the plants can get their natural rest period. Inexpensive timers that turn the lights on and off automatically are available at nurseries and hardware stores.

Watering your seedlings

Water fragile seedlings carefully, or you risk uprooting them. Mist them with a gentle spray, or water them from the bottom by setting your container in a pan of water just long enough for the soil surface to wet (keeping them in water longer than this can damage the plants' roots). After the surface is wet, remove the container from the water and let it drain. Keep the soil surface lightly moist but not soggy. Always water with lukewarm water, and try to do so early in the morning, if possible. This way the foliage can dry off quickly during the day to avoid disease problems.

As your plants get sturdier, you can water with a sprinkling can that has a *rose,* a nozzle that breaks the water into many fine streams. After the plants grow their first set of true leaves (the first leaves to open as the seed germinates are called *seedling leaves,* and the next set are *true leaves*) and have a bigger root system, let the soil dry out slightly between waterings.

WARNING

Give the plants enough water at one time so that some of it runs out the drainage holes in the bottom of the container, but never leave the container sitting in water. Overwatering promotes damping-off disease (see the sidebar "Dealing with damping off") and decreases the amount of air in the soil, resulting in a weaker root system.

With soilless mixes, you may have a difficult time deciding when to water, because the soil looks dry on the surface even though plenty of moisture is still present. To check whether the soil has moisture, take a small amount of soil off the top ½ inch of mix and squeeze it between your fingers. If you can squeeze out any water, hold off watering. The difference in a container's weight when the soil is moist compared to when it's dry can also indicate when to water. Dry soil is very light. Finally, wilted seedlings also are a sure sign that you've waited too long to water (unless, of course, your plants have damping off).

Certain types of containers require more frequent watering. For example, soil in clay pots dries out faster than soil in plastic pots. Peat pots dry out fast and are difficult to rewet. Try putting your peat pots or growing-cubes in a tray and packing moist peat moss between them to keep them from drying out too quickly.

TIP

Self-watering seed starting kits that reduce the need for checking your seedlings daily for dryness are now available. These kits have a reservoir of water in the bottom of the tray that wicks into the pots when the soil is dry. See the appendix for companies carrying seed starting supplies.

DEALING WITH DAMPING OFF

One day you're admiring your strong, healthy seedlings, and the next day you're gaping in dismay at the sight of them toppled over and dying. The attacker is called *damping off,* which is a fungus that infects young seedlings, sometimes even before they have a chance to emerge from the soil. If you examine infected seedlings closely, you usually can see that part of the stem near the soil line is sunken, shriveled, and water soaked. Sometimes a white mold also forms on the stem.

Damping off is one of the most common problems that seed-starters face, but fortunately you can control it with good sanitation and cultural practices (proper watering, fertilizing, and lighting). Sterilizing containers with a bleach solution and using sterile potting soil go a long way toward preventing problems. Wet potting soil and high nitrogen encourage this fungus, so avoid overwatering, and use a well-drained germinating mix that's low in nitrogen. Or consider using fertilizer only after the seedlings develop their first true leaves. Sowing seeds thinly to allow good air circulation also can help. Many seeds come coated with a fungicide that helps prevent damping off.

If you notice seedlings in one portion of a container beginning to wither, cut them off and remove the soil around them as quickly as possible. Then do whatever you can to make conditions less favorable for the fungus (basically, let the soil dry more). With luck, you'll be able to save the rest of the batch.

Thinning and transplanting indoors

REMEMBER

After seedlings develop their first set of true leaves (or when onions or leeks, which send up a single blade, are 2 inches tall), you need to thin them or move them from shallow flats to larger quarters. Thinning is an important step, and timing is crucial. If you let your seedlings grow too large in a small container, their growth is stunted. And if you don't space them out at all, you end up with weak plants.

To thin plants that will continue growing in the same container, snip out extra seedlings at the soil line with a pair of scissors, as shown in Figure 4-2. If you try to pull these seedlings out, you may disturb the roots of the plants that are staying. Also be sure to snip out any weak or misshapen plants. The appendix explains how much space to leave between different types of vegetable seedlings.

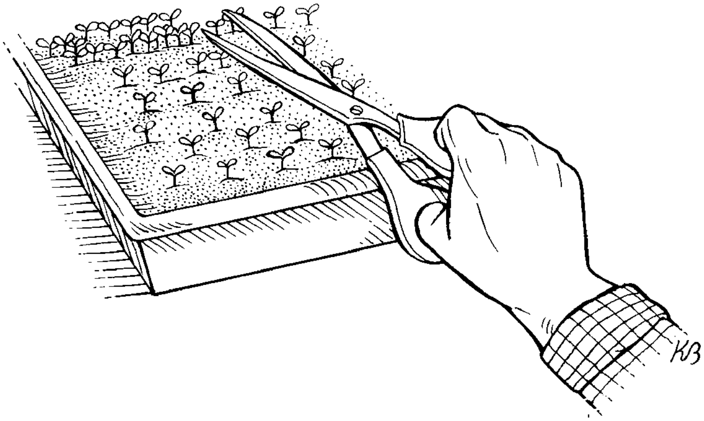


FIGURE 4-2: Thin seedlings at the soil line with scissors.

To move seedlings to a new container, first fill a larger container (plastic six-packs, 4-inch pots, or peat pots) with moist potting soil. Poke holes in the soil large enough to put the seedling roots in — the eraser end of a pencil is a good tool for this. Dig around the plants carefully by using the blade of a table knife or a small stick, such as a plant label, and then lift the seedlings out of the soil. Always hold the seedlings by the tips of their leaves; otherwise, you can easily crush their delicate stems or injure their growing tips. Set the plants in the new container, slightly deeper than they were growing before. Firm the soil gently around the roots, water well, and keep the plants out of direct sun for a day or two until they adjust to their new pots.

Feeding your seedlings

Regular fertilizing helps produce strong, healthy plants. Some potting soils already have fertilizer mixed in, and in that case you don't have to add more. For other types, use a diluted water-soluble fertilizer to one-third strength (usually

1 teaspoon of fertilizer per gallon of water) to water your seedlings. Water with the solution once a week. For more on fertilizers, see Chapter 5 of this minibook.

Transplanting Indoor Seedlings and Starter Plants

After you nurture your seedlings indoors for a good four to eight weeks, and when the weather's right for planting, you're ready to transplant the seedlings outdoors. Or maybe you haven't grown seedlings at all, but you want to buy some starter plants at a nursery and get them in the ground. Both scenarios are examined in the following sections.

Buying starter plants

If you don't start your transplants from seeds at home, you can buy them at a nursery or garden center. You can find seedlings of almost every type and size around planting time. However, the range of varieties available will be greater if you start your own transplants from seed.

Follow these tips when buying starter plants:

- **Choose healthy-looking plants.** Tomatoes, for example, should have a stocky stem, be about 4- to 6-inches tall, and sport dark-green foliage.
- **Avoid large, crowded, spindly plants in small containers.** The roots of these types of plants are often bound up and have no room to grow. You can check the roots for yourself by gently removing the transplants from their containers (if you aren't sure how to do this, see "Making the big move to the ground," later in this chapter). If you see a dense mat of roots around the outside of the *root ball* (the soil with roots growing in it), the plants probably have been in the pot too long.
- **Buy plants at the optimum size.** Plants with four to six leaves and short, stocky stems are usually best. In general, younger plants are better than tall, older plants that most likely were stressed at one point or another.
- **Avoid plants that are already flowering and have fruit on them.** Plants with flowers and fruits never produce well.

  WARNING

  You can sometimes buy large tomato plants in 1-gallon or larger pots — sometimes they even have tomatoes on them. But beware, these large plants rarely grow well after you get them home. You'll likely have better luck with smaller transplants that can get off to a running start.

You can buy vegetable transplants locally, but many mail-order seed companies now also offer a wide range of vegetable varieties as small plants or plugs. The plants usually are in good shape. They offer a wider selection than you can find in garden centers, you don't have to drive around to find the best transplants, and they ship plants to you at the appropriate planting time for your region.

Toughening up all types of transplants

Vegetable seedlings that are grown indoors at home or purchased from a greenhouse or nursery in spring need to acclimate gradually to the brighter light and cooler temperatures of the outside world. This process, called *hardening off*, slows plant growth, causing the plants to store more food internally and increase the thickness of their outer leaf layers. Basically, hardening off toughens up transplants for the cold, cruel, outside world.

To harden off your transplants, follow these steps:

1. **A week or two before you intend to set plants out in your garden, stop fertilizing and reduce the amount of water you give them.**

   Give plants just enough water so they don't wilt.

2. **Take your plants outside for a short time.**

   Give the plants a half hour of filtered sunlight — setting them under an arbor or open-branched tree — during the warmest part of the day. If the weather is windy, put the plants in a spot where they're sheltered, or construct a windbreak out of pieces of wood.

3. **Gradually increase the amount of time that the plants spend outside and the intensity of the light that they're exposed to.**

   You want to increase the amount of time your plants are outside so that by day seven, they're out all day. Move them into progressively sunnier locations during the week so they get used to their future condition in the ground. However, make sure that you bring the plants in every night.

Another option is to move your plants to a cold frame (see Chapter 7 of this minibook to learn more or Book 5, Chapter 1 to build one), and then you can open the cold frame more each day and close it at night. Plants that are raised in a cold frame from the time that they're young seedlings will need much less hardening off.

WARNING

Don't overharden your plants. Certain crops, such as cabbage and broccoli, can quickly *bolt* (flower before they're supposed to) if seedlings older than three weeks are repeatedly exposed to temperatures lower than 40 degrees for a couple of weeks.

Making the big move to the ground

Before transplanting your homegrown seedlings or nursery-bought transplants, you need to prepare your soil and sculpt beds or rows, and your garden must be ready to plant (see Chapter 3 of this minibook for more prep work). If you're worried about keeping the rows straight, use string and stakes as described in the later section "Row planting."

Choose a calm, cloudy day to transplant, if possible. Late afternoon is a good time because plants can recover from the shock of transplanting without sitting in the midday heat and sun. Your garden soil should be moist, but not soggy. If the weather has been dry, water the planting area the day before you plant. Moisten the soil in your flats or pots so it holds together around the plants' roots when you remove the plants from their containers.

TIP

When setting out plants in biodegradable peat pots, make slits down the sides of the pots or gently tear the sides to enable the roots to push through. Also, tear off the lip (top) of the pot so it doesn't stick up above the soil surface and pull moisture out of the soil. If you're using premade growing blocks encased in netting, cut off the netting before planting.

To transplant seedlings, follow these steps:

1. **Use a hoe, spade, or trowel to make a small hole in your garden for each seedling.**

   The hole should be deep enough so the transplant is at the same depth in the ground as it was in the pot (except for tomatoes). Make the hole twice as wide as the root ball.

2. **Unpot a seedling (unless it's in a peat pot) by turning its pot upside down and cupping the seedling with your hand.**

   Be sure to keep the root mass and soil intact. If the seedling doesn't come out easily, gently tap on the edge of the pot or gently press on the bottom of each cell of the flat with your fingers. Whatever you do, don't yank out a plant by its stem.

3. **Check the root ball's condition.**

   If the roots are wound around the outside of the pot, work them loose with your fingers so they can grow out into the soil. Unwind larger roots and break smaller ones (this won't hurt them) so they all point outward. Try to keep as much of the original soil intact as possible.

4. **Mix a diluted liquid fertilizer into the soil of the planting hole to help the plants get off to a fast start.**

   Reduce the recommended strength on the fertilizer container by half. For example, if it says apply 1 tablespoon per gallon of water, use only ½ tablespoon.

5. **Put each prepared seedling into the holes that you made.**

   TIP

   Most young vegetables should be planted at the same soil level as they were in the pot, as shown in Figure 4-3. For some vegetables, such as tomatoes, you can sink the seedling a little deeper. They grow extra roots along the lower portion of their stems and thrive with this treatment.

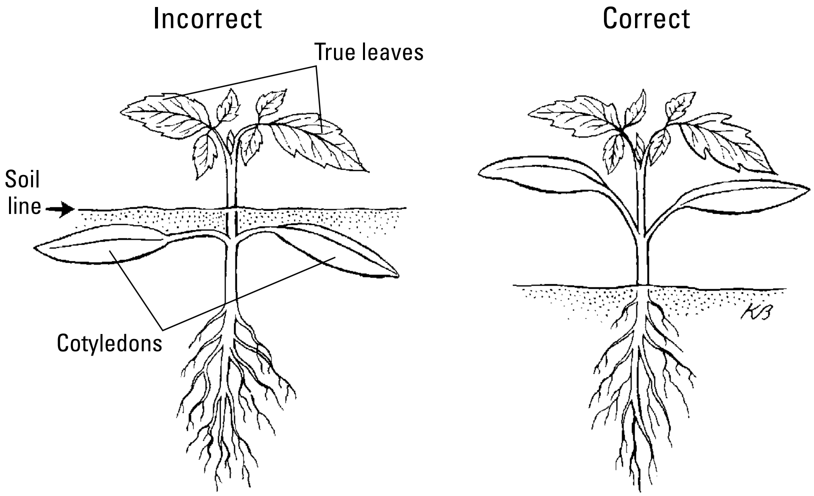


FIGURE 4-3: Plant vegetable seedlings at the correct depth.

6. **After firming the soil around the roots with your hands, form a shallow soil basin around the base of the transplant.**

   The soil basin serves as a moat around the seedling to hold water. When you water or it rains, the moisture stays in the moat and drains to where the roots are located. Chapter 3 of this minibook provides more information on soil basins.

7. **Depending on the conditions, water the bed that day or the next.**

   If the weather has been dry or if the soil is sandy, you may want to water the entire bed; if it's rainy or the soil is already very wet, wait until tomorrow to water.

8. **Keep the bed moist while the seedlings get established and begin to grow strongly.**

   In extreme hot, dry weather, provide temporary shade for transplants with paper tents or wooden shingles pushed into the ground on the south or west side of the plants.

REMEMBER

If you don't get an ideal transplanting day and the weather is hot and sunny, shade the plants until the sun goes down. And don't be alarmed if your plants look a little droopy after you set them out; they'll soon recover. Cabbage seedlings can droop and look almost dead, for example, and be up and growing in a day or two.

Sowing Seeds Directly in Your Garden

Unless you live in an area where summers are really short, some vegetables are better off sown directly in a garden rather than as transplants. Large-seeded, fast-growing vegetables — such as corn, melons, squash, beans, and peas — usually languish if they're grown in containers for even a day or two too long. Plants sown directly in the ground usually surpass these seedlings if both are planted at the same time. (Even if you live in a short-season area, you can help speed new plants along. See Chapter 7 of this minibook for information on extending your growing season.)

The following sections describe different methods for planting seeds right into your garden and show you how to thin seedlings carefully.

Deciding on a seed-planting method

You can plant seeds in a variety of patterns: single rows, wide rows, beds, raised beds, or hills. The method you choose depends on your climate, your tools, and your taste. You can find out more about these planting methods in Chapter 3 of this minibook. Whichever method you choose, here are a few basic principles to keep in mind when planting seeds:

- **Make sure that the soil has dried out sufficiently before you work it, and be sure that the soil is warm enough for the seeds that you want to plant.** Pea seeds, for example, germinate in soil as cool as 40 degrees, and you can plant them as soon as you can work the soil in spring. Squash seeds, on the other hand, need warmth. If your soil temperature is much below 65 degrees, the seeds are likely to rot in the ground before they sprout. (See the appendix for a list of appropriate soil temperatures for different kinds of seeds.) The best way to determine the temperature of your soil is to use a soil thermometer, which you can buy at a garden store.
- **Immediately before planting seeds, loosen your garden soil with a hoe or shovel to a depth of 6 inches.** Rake over the area to create a smooth planting surface. Don't walk over areas where you'll be sowing seeds; stay in the pathways. Compacting the soil makes it difficult for seedlings to emerge and send down their roots.

- **Sow seeds at the proper planting depth.** A seed planted too deeply uses up its supply of stored nutrients before the seedling can push its way to the surface; a seed planted too shallow may dry out. A general rule is to plant seeds to depths that are two to three times their diameters, but the appendix gives recommended planting depths for different kinds of seeds. Also try to sow at a uniform depth because seedlings are more likely to emerge at the same time, enabling you to see where your plants are when you do your first weeding.

WARNING

- **Water newly planted seeds carefully.** Use a watering can with a rose (nozzle with multiple holes) or a hose with a *breaker attachment* (a nozzle that breaks the stream into a gentle spray). A strong stream of water can wash seeds out of a bed or too deeply into the ground. Keep the seeds moist but not soggy until the seeds germinate. Heavy soils often form a crust as they dry out, making it difficult for the seedlings to break through. A moist surface helps prevent crusting, as does covering seeds with vermiculite or sand, instead of soil alone. If the weather is dry after you sow the seeds, gently water the seeded area every two days or so.

The following sections explain the basic methods for planting your seeds.

Row planting

The first step when row planting is to mark the placement of a row within your garden. A planting line consisting of a simple string and stakes enables you to easily lay out rows. Make a *furrow*, or trench, at the correct depth along the row. To make a shallow furrow, lay a rake or hoe underneath your string marker, and press the handle into the soil. You can make deeper furrows (ones that can be used for watering, too) by dragging the corner of your hoe across the soil surface, using the string as your guideline.

Sow seeds more thickly than you want the final spacing of the crops to be to ensure an adequate number of plants; some seeds may fail to sprout. Thinning rows is less of a chore if you space seeds as evenly as possible. Large seeds such as peas and beans are easy to space at precise intervals, but evenly spacing small seeds can be a real challenge.

Cover the seeds with fine soil and then firm them in with the back of a hoe to make sure that all the seeds are in contact with the soil. Water gently.

TIP

If you're planting long rows of corn, beans, or peas that will be furrow-irrigated (see Chapter 3 of this minibook), fill the furrows with water first and then push the large seeds into the top of raised beds.

Wide row planting

You can plant more seeds in less space and get higher yields by using the wide row planting method. (Figure 4-4 compares wide rows and straight single rows.) This method not only saves space but also allows you to concentrate watering, weeding, and fertilizing in a smaller area. Follow these steps for wide row planting:

1. **Choose the location and width of your row, usually 10 to 16 inches wide, and then smooth the soil until it's level.**

   You may want to run strings along the outside edges of the row to clearly designate the planting area.

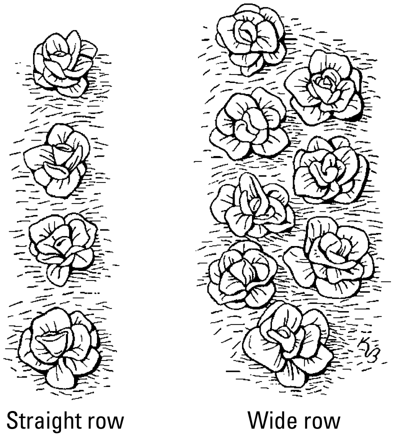


FIGURE 4-4: Straight single rows versus wide rows.

2. **Sprinkle seeds over the entire row — with most crops, try to land the seeds about ½ to 1 inch apart (for peas and beans, 1½ to 2 inches).**

   Pat the seeds down with the back of a hoe.

3. **Use a rake to lift soil from the side of the row to cover the seeds, and gently smooth the soil covering the seeds to the same depth throughout the row.**

   TIP

   Cover small seeds (such as carrot and lettuce seeds) with a thin layer of potting soil. Then pat the potting soil down again to bring the added soil into firm contact with the seeds.

4. **Water the seeds gently.**

   Keep the soil moist by gently watering a few times a week or when you see that the top layer of soil is drying out.

Raised bed planting

Planting raised beds is essentially the same as planting wide rows. If you don't have permanent beds, mark the dimensions and smooth out the soil. You can broadcast sow (sprinkle by hand) in single rows with a few inches between rows, as shown in Figure 4-5, or you can plant individual seeds at the proper distance apart.

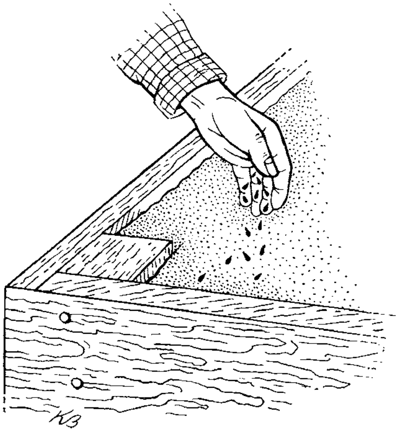


FIGURE 4-5: Broadcasting seeds in a raised bed.

Hill planting

Plant seeds for vining crops that spread out — such as squash, melons, or cucumbers — in hills or circular groups, as shown in Figure 4-6. Loosen and level the soil in a 1-foot-diameter area, and then plant five to six seeds close together. After the second set of true leaves form, keep the two strongest seedlings (the ones that are the biggest and sport the most leaves) and thin out the remaining seedlings by cutting them with scissors (see the next section for details).

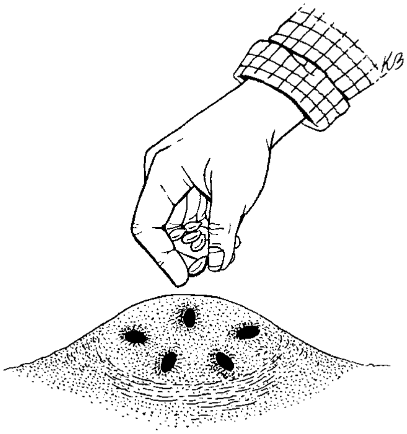


FIGURE 4-6: Sow vining crop seeds in hills.

TIP

If your soil is heavy, you may want to plant in a *raised hill* (also called a *mound*). The raised soil warms up more quickly than the surrounding soil and drains better. But be careful in midsummer not to let the mound dry out. You can easily construct a soil basin around the mound for watering (see Chapter 3 of this minibook).

Thinning seedlings in your garden

Soon after seedlings grow their second set of true leaves, you need to thin them out. Don't neglect this important step; crowded seedlings turn into weak, spindly plants that don't produce well. Separate the plants by hand or with a narrow hoe.

REMEMBER

When you thin plants, either discard the extra seedlings or move them to another part of your garden. Newly transplanted seedlings need extra attention until they get established. Shade them from the hot sun for a day or two and be sure to keep them well watered. Lettuce is one of the easiest vegetables to move when it's small. Root crops such as beets and carrots transplant poorly, as do beans and peas.

You can thin some crops in stages, with delicious results. Carrots, lettuce, and beets are all good candidates for gradual thinning. If you've ever tasted beet greens cooked up with tender, marble-sized beets still attached, you know what a real treat they are. Start thinning carrot, lettuce, and beet seedlings when they're 1 to 2 inches apart. After the plants grow to 6 to 8 inches tall, pull up every other one and enjoy them. Leave a final 4- to 6-inch spacing for larger plants to develop.

Planting Guidelines

The best way to plan your garden is to start by deciding how much produce you want. For example, if you like lettuce, 25 heads will take approximately 25 feet of row. The recommended distances between rows in Table A-1 tell you how much space to leave between crops.

Use the information in Table 4-2 as a general guideline. You may choose to vary the distance between rows, for example, depending on the method of planting or cultivating. You usually can hand-hoe weeds between rows adequately in 18- or 24-inch-wide pathways; rototilling is faster, but pathways should be 30 or 36 inches wide to do so. If you garden intensively, such as in raised beds, you can space plants closer than indicated in the chart.

The days to maturity and the yield figures are averages. Depending on weather, soil fertility, pests, and weed pressure, yield and maturities in your garden can vary greatly. Just remember, you can always find friends, relatives, and bunnies who'd love some fresh, homegrown produce.

TABLE 4-2 Planting Guide

Crop	Seed/ Plants per 100 ft Row	Frost Tolerance	Planting Depth (Inches)	Spacing between Rows (Inches)	Spacing between Plants (Inches)	Soil Temp for Germination*	Average Days to Germination	Average Days to Maturity	Average Yield per 10 ft Row
Asparagus	1 oz/65	Very hardy (R)	6 (crowns)	36–48	18	50–95 (75)	7–21	2 years	3 lb
Beans, snap (bush)	½lb (seeds only)	Tender	1–1½	18–24	3–4	60–95 (85)	6–14	45–60	12 lb
Beans, snap (pole)	½lb (seeds only)	Tender	1–1½	36–48	4–6	60–95 (85)	6–14	60–70	15 lb
Beans, lima (bush)	½lb (seeds only)	Very tender	1–1½	18–24	3–4	60–85 (80)	7–12	65–80	2.5 lb, shelled
Beans, lima (pole)	¼lb (seeds only)	Very tender	1–1½	36–48	12–18	60–85 (80)	7–12	85–90	5 lb, shelled
Beets	1 oz (seeds only)	Hardy	½	15–24	2	40–95 (85)	7–10	50–60	12 lb
Broccoli	¼oz/45	Very hardy (P)	¼	24–36	14–24	40–95 (85)	3–10	60–80	10 lb
Brussels sprouts	¼oz/55	Very hardy (P)	¼	24–36	14–24	40–95 (85)	3–10	90–100	7.5 lb
Cabbage	¼oz/55	Very hardy (P)	¼	24–36	14–24	40–95 (85)	4–10	60–90	18 lb
Carrots	½oz (seeds only)	Hardy	¼	15–24	2	40–95 (80)	10–17	70–80	15 lb
Cauliflower	¼oz/55	Hardy (P)	¼	24–36	14–24	40–95 (80)	4–10	70–90	10 lb
Celery	1⁄64 oz/200	Hardy	1⁄8	30–36	6	40–75 (70)	9–21	125	18 stalks
Chinese cabbage	¼oz/65	Hardy (P)	¼	18–30	8–12	40–105 (80)	4–10	65–70	8 heads

(continued)

TABLE 4-2 ***(continued)***

Crop	Seed/ Plants per 100 ft Row	Frost Tolerance	Planting Depth (Inches)	Spacing between Rows (Inches)	Spacing between Plants (Inches)	Soil Temp for Germination*	Average Days to Germination	Average Days to Maturity	Average Yield per 10 ft Row
Corn	3–4 oz (seeds only)	Tender	2	24–36	12–18	50–95 (95)	6–10	70–90	1 dozen
Cucumbers	½oz/30–40	Very tender	1	48–72	24–48	60–105 (95)	6–10	50–70	12 lb
Eggplant	1⁄8 oz/50	Very tender (P)	¼–½	24–36	18–24	65–95 (85)	7–14	80–90	10 lb
Leeks	½oz/300	Very hardy	½–1	12–18	2–4	45–70 (75)	7–12	130–150	12 lb
Lettuce, heading	¼oz/120	Very hardy	¼–½	18–24	6–10	32–75 (75)	4–10	70–75	10 heads
Lettuce, leaf	¼oz/400	Very hardy	¼–½	15–18	2–3	32–75 (75)	4–10	40–50	5 lb
Muskmelon	½ oz/50	Very tender	1	60–96	24–36	65–105 (95)	4–8	85–100	5 fruits
Okra	2 oz/50	Very tender	1	36–42	12–24	60–105 (95)	7–14	55–65	10 lb
Onion, seed	1 oz/300	Very hardy	½	15–24	3–4	32–95 (80)	7–12	90–120	16 lb
Onion, sets	400–600 (no seeds)	Very hardy	1–3	15–24	3–4	NA	NA	80–120	10 lb
Parsley	¼oz/150	Hardy	¼–½	15–24	6–8	50–90 (75)	14–28	70–90	4 lb
Parsnips	½ oz (seeds only)	Hardy	½	18–30	3–4	32–85 (70)	15–25	120–170	10 lb
Peas	1 lb (seeds only)	Very hardy	2	18–36	1	40–85 (75)	6–15	55–90	4 lb
Peppers	1⁄8 oz/50	Very tender	¼	24–36	18–24	60–95 (85)	10–20	60–90	30 lb
Potatoes	6–10 lb seed potatoes	Very hardy (R)	4	30–36	8–10	NA	NA	75–100	10 lb

Crop	Seed/ Plants per 100 ft Row	Frost Tolerance	Planting Depth (Inches)	Spacing between Rows (Inches)	Spacing between Plants (Inches)	Soil Temp for Germination*	Average Days to Germination	Average Days to Maturity	Average Yield per 10 ft Row
Pumpkins	½ oz/25	Very tender	1–2	60–96	36–48	65–105 (95)	6–10	75–100	10 lb
Radishes	1 oz (seeds only)	Hardy	½	14–24	1	40–95 (80)	3–10	25–40	10 bunches
Rhubarb	20 (no seeds)	Very hardy (R)	4	36–48	48	NA	NA	2 years	7 lb
Southern peas	½ lb (seeds only)	Very tender	½–1	24–36	4–6	60–95 (85)	7–10	60–70	4 lb
Spinach	1 oz/300	Very hardy	¾	14–24	3–4	32–75 (70)	6–14	40–60	4–5 lb
Squash, summer	1 oz/40	Tender	1	36–60	18–36	65–105 (95)	3–12	50–60	25 lb
Squash, winter	½ oz/35	Very tender	1	60–96	24–48	65–105 (95)	6–10	85–100	15lb
Sweet potatoes	75–100 (no seeds)	Very tender (P)	NA	36–48	12–16	NA	NA	100–130	10 lb
Swiss chard	1 oz/50	Hardy	½	12–15	24–36	40–95 (75)	5–16	50–60	50–75 lb
Tomatoes	⅛ oz/50	Tender	½	24–48	18–36	50–95 (80)	6–14	70–90	80 lb
Turnips	½ oz (seeds only)	Very hardy	½	14–24	2–3	40–105 (80)	3–10	30–60	5–10 lb
Watermelon	1 oz/20	Very tender	1	72–96	36–72	65–105 (95)	3–12	80–100	4 fruits

P — plants; R — roots; NA — not applicable; Very hardy — plant outside four to six weeks before average last spring frost date; Hardy — plant outside two to three weeks before average last spring frost date; Tender — plant outside on average date of last spring frost; Very tender — plant outside one to two weeks after average last spring frost date

**Range of germination temperature in degrees Fahrenheit; optimum germination in parentheses*

IN THIS CHAPTER

- Understanding how and when to water your crops
- Making your own compost
- Feeding your plants with fertilizer
- Using mulch to retain moisture and suppress weeds
- Maximizing your efforts with rotating crops and succession planting
- Harvesting your crops at the perfect moment

Chapter 5

Growing Your Garden

After planting your garden, you need to keep your vegetables growing vigorously until harvest. Maintaining your vegetable garden is similar to running a long-distance road race. After you're off and running, the key is to pace yourself for the entire race and not burn out in the beginning.

You must have lots of enthusiasm to prepare the soil and plant, but you also have to be consistent about checking plants, watering, fertilizing, and harvesting (among other tasks) to get the best results. If you lose interest in your garden halfway through the growing season, your harvest may be small or poor. Don't worry though; your garden won't require all your time — just some of it each week.

This chapter serves as a checklist of sorts of the things you should be doing throughout the growing season to keep your vegetables happy as you work toward the all-important harvest.

Introducing Your Inner Gardener to the Watering Basics

Even though Mother Nature is often very generous with rain, she still sometimes leaves gardens with a dry spell. Flooding isn't good for your garden, but neither is drought. If your plants don't have adequate water at the right times, they can easily die.

It's a good idea to think about how you'll water your garden plants even in the garden planning stages (as discussed in Chapter 1 of this minibook). But now that everything is in the ground, you need to actually *do* the watering.

Following guidelines for watering seeds and plants

Different crops have different water needs. Some vegetables, such as celery, are real water lovers and prefer to have moist soil around their roots at all times. Shallow-rooted crops (such as onions and cabbage) need more careful watering during dry spells than deeper-rooted crops (such as tomatoes) that can pull water from greater depths.

REMEMBER

You also need to keep in mind a plant's growth stage when watering. Here are some general watering guidelines for different growth stages:

- **Seedlings and germinating seeds:** Seedlings with small root systems near the soil surface and germinating seeds benefit from frequent, gentle watering, which enables them to sprout and emerge quickly. Water once a day to a few inches deep if it doesn't rain. (Chapter 4 of this minibook has more details on seedlings and transplants.)
- **Transplants:** Water transplants when they're first planted in the garden and then every few days after that to 6 inches deep or so. Watering frequently helps the roots recover from transplant shock.
- **Established plants:** Plants that have been in your garden for a few weeks and that are beyond transplant shock need to be watered deeply. Try to wet the soil at least 6 inches deep. Watering to this depth encourages roots to penetrate deeply, where they're less susceptible to drought. Give the soil a chance to dry out slightly (three to six days if it doesn't rain) before watering thoroughly again.

TIP

When you're advised to water to a certain number of inches, don't feel like you have to guess when you've hit the mark; you can dig into the soil with a trowel to see how far the water has penetrated.

In the following sections, you'll learn when to quench your veggies' thirst and get information on different watering methods.

Knowing when your veggies need a drink

In general, most vegetables use about 1 inch of water per week (1 to 2 inches in hot, windy, dry climates). If you don't get water from rainfall, you have to supply it. Here are some general guidelines for determining when your plants need water:

- **Your finger is the best indicator of when the soil has dried sufficiently to re-water.** Dig down several inches into the soil; if the soil is dry to your touch 3 to 4 inches down, it's time to water.
- **Wilting plants can be a sign that your soil needs water.** *Wilting* is when the leaves or stems of a plant droop, bend over, and look limp. These symptoms, however, can be misleading at times. Some plants, such as tomatoes, peppers, and eggplants, tend to droop slightly during the heat of the day, even if the soil has enough moisture. If your plants don't stand tall and proud and the soil feels dry, add water and watch them perk up fast.

  WARNING

  Overwatering also causes plants to wilt, so check the soil before watering. If the soil is waterlogged, roots die from lack of air. With fewer roots, plants can no longer take up the water they need from the soil, and so they wilt. Damage from insects and disease also cause wilting.
- **Each vegetable has a critical period when you need to be especially careful about watering.** If you slack off during these times, your crop may be ruined. Table 5-1 shows the important watering periods for different types of vegetables.

TABLE 5-1 Critical Watering Periods for Vegetables

Vegetable	Important Watering Stage
Bean, lima	When flowering and forming pods
Bean, snap	When flowering and forming pods
Broccoli	When forming a head
Brussels sprouts	When forming sprouts
Cabbage	When forming a head
Carrots	When forming roots
Cauliflower	When forming a head

(continued)

TABLE 5-1 ***(continued)***

Vegetable	Important Watering Stage
Corn, sweet	When silking, tasseling, and forming ears
Cucumber	When flowering and developing fruit
Eggplant	From flowering through harvest
Lettuce	When true leaves form
Melon	During fruit set and early development
Onion, dry	During bulb enlargement
Pea	When flowering and during seed enlargement
Pepper	From flowering through harvest
Potato	When tubers set and enlarge
Pumpkin	When fruits form
Radish	When forming roots
Spinach	When true leaves form
Squash, summer	When forming buds and flowering
Swiss chard	When true leaves form
Tomato	From flowering through harvest
Turnip	When forming roots

Digging Into Composting

A beneficial, soil-like substance, *compost* is a mixture of decayed and decaying organic matter that improves soil structure and provides nutrients for plants. *Composting* is a method for you to copy nature's process, speeding it up if you so choose, to ultimately reap a rich mound of soil-enhancing compost for your landscape.

For gardeners, compost is sometimes called "black gold." You can add finished compost to the garden or around plants at any time. Doing so is considered by many to be the single most beneficial thing you can do for your garden.

Perhaps best of all, it's easy: you can't fail at composting. Isn't that a nice thing to know at the start of a project? Organic matter will rot no matter what you do. Fuss over it daily or ignore it for months; it doesn't matter. So, dig right in and enjoy the process!

Why not just add raw organic matter to your garden instead of composting it? When you compost the materials first, the final product is uniform in color, nutrients, and texture; is odor free; and contains fewer viable weed seeds and potential disease organisms (depending on how it was composted). Your plants will be happy with you for treating them so well.

You can buy compost in bulk (back the truck right up) or bagged, depending on where you live. The following sections explain these options. For many gardeners, making their own compost is the best solution. For information, head to the section "Compost happens: making your own."

Buying bagged compost

Bagged compost is the easiest form to buy, especially if you have a small yard or container garden. Look for the words "certified organic," the "OMRI Listed" seal, or some other indication that the contents are approved for organic growing and don't come from contaminated sources, such as sewage sludge. (OMRI — the Organic Materials Review Institute, or OMRI — certifies products that meet the National Organic Standards.)

Buying compost in bulk

For larger quantities of compost, buy in bulk. The price is less in quantity, and you can check the quality of the compost as well. Many private companies, municipalities, and community groups make and sell compost. Often, they even deliver the compost to your yard for a fee.

TIP

Use these tips to evaluate bulk compost:

- **Consider the source.** Before buying the compost, ask about the primary, organic-matter sources that were used to make the compost. Compost made from yard waste (leaves and grass clippings) is considered to be the safest and best. Other compost may contain ingredients that had contaminants, such as herbicides from agricultural crop residues and heavy metals from municipal wastes, which may affect the growth of your plants or accumulate toxins in your soil. Ask if the finished product is tested for contaminants.
- **Look at the color and texture.** Finished compost should look dark and have a crumbly texture without any large pieces of undecomposed organic matter, such as branches or pieces of wood.

- **Squeeze it.** If water oozes out when you squeeze a handful of the material, it's too wet; if it blows away easily, it's too dry.
- **Give it a whiff.** The smell should be earthy, without a strong ammonia or sour smell.

Compost happens: making your own

Making your own compost is probably the simplest way to ensure high-quality compost and save some money. The process really isn't as complicated as you may think; the many commercial composting bins and containers on the market (see Figure 5-1) make composting a mess-free, hassle-free process. For steps on building your own compost bin, refer to Book 5, Chapter 1.)

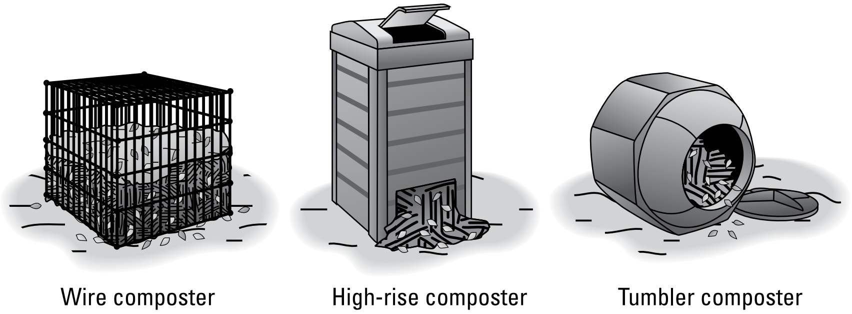


FIGURE 5-1: Commercial composters.

Building a good compost pile involves much more than just tossing organic materials in a pile in the corner of your yard, though many people use this technique with varied success. Because, you know, everything does eventually rot. But to compost correctly, you need to have a good size for your pile, add the right types and amount of materials, and provide the correct amount of moisture.

REMEMBER

Here are the characteristics of a well-made pile:

- It heats up quickly — a sign that the decay organisms are at work.
- Decomposition proceeds at a rapid rate.
- The pile doesn't give off any bad odors.
- The organisms that do all the decay work take up carbon and nitrogen (the stuff they feed on and break down) in proportion to their needs.

You can easily come up with the correct amounts of materials for a compost pile by building the pile in layers. Just follow these steps:

1. **Choose a well-drained spot in your yard.**

   If you build your compost pile on a naturally wet spot, the layers will become too wet and inhibit the decomposition process.

2. **Create a 4- to 6-inch layer of brown materials that are rich in carbon.**

   These brown materials include roots and stalks of old plants, old grass clippings, dried hay, and leaves. The more finely chopped these materials are, the more surface area that decay organisms can attack, and the faster the materials decompose.

3. **Add a thin layer of green materials that are high in nitrogen.**

   Green materials include green grass clippings, kitchen vegetable scraps, a 2- to 4-inch layer of manure, or a light, even coating of blood meal, cottonseed meal, or organic fertilizer high in nitrogen.

4. **Repeat the green and brown layers (Steps 2 and 3) until the pile is no more than 5 feet high.**

   WARNING

   If a pile is higher than 5 feet, too little oxygen reaches the center of the pile, enabling some nasty anaerobic decay organisms to take over and produce bad odors. Five feet is a good maximum width for the pile as well.

Here are a few additional ways to ensure success in your compost pile:

- **Moisten each layer of your compost pile lightly with a watering can as you build it.** However, don't let the pile get soggy.
- **Cover each layer with a few inches of garden soil.** The soil covers any material in the nitrogen layer that may attract flies, such as household garbage.
- **Add a dusting of ground limestone or wood ashes on the carbon layer.** This dusting keeps the compost's pH around the 6 to 7 mark that your plants like.

Avoiding materials that don't belong in a compost pile

WARNING

A well-made pile heats up enough to kill off many insects and disease organisms, but the heating isn't uniform enough to be relied on to kill everything that you want it to. So don't add the following materials to your pile:

- **Diseased or infected plant material:** Disease organisms may survive the composting process and stick around to reinfect your plants when you apply the finished compost.

QUICK AND EASY COMPOST RECIPES

To make the most compost in the shortest time, try some of these proven recipes. For each recipe, mix the ingredients thoroughly, and follow the directions earlier in this chapter. Depending on the weather and compost ingredients, you should have finished compost within one to two months.

- **Recipe 1:** Use 4 parts kitchen scraps from fruits and vegetables, 2 parts chicken or cow manure, 1 part shredded newspaper (black ink only), and 1 part shredded dry leaves.
- **Recipe 2:** Use 2 parts kitchen scraps, 1 part chicken manure, and 1 part shredded leaves.
- **Recipe 3:** Use 2 parts grass clippings, 1 part chicken manure, and 1 part shredded leaves.

- **Weeds that have gone to seed:** The heat may not be high enough to kill the weed seeds. And then those weeds will show up in your garden.
- **Pieces of aggressive weeds such as quack grass or Bermuda grass:** Even a small piece of a root can produce a new plant.
- **Grass clippings from lawns treated with herbicides:** Some herbicides may not break down during the composting process.
- **Meat scraps and fats:** They break down slowly and may attract animals to the pile.
- **Dog or cat feces:** They may carry diseases that can be transmitted to humans.

Moistening and turning your compost pile

After you build your compost pile, the decay process begins, causing the center of the pile to heat up. Proper moisture helps decay organisms to work properly. Following are some ways to keep your compost pile moist:

- Water the pile as needed. To determine whether you need to water, dig about 1 foot into the pile and see if it's moist.

WARNING

- Be careful not to overwater your pile. It's easy to do. The water seeps in and tends not to evaporate readily, so people think the pile is dry when it's not.
- If there's a long dry spell or if you live in a dry-summer area, water the entire pile to keep it lightly moist.
- Make a depression in the top of the pile to collect rainfall.

You also must turn the pile periodically to aerate it, prevent it from overheating, and ensure that all the material decomposes uniformly. You can turn your compost pile by forking the material from the outside of the pile to the center or by moving the pile from one area to another. If you made a pile out of wire fencing, simply unhook the ends, pull the fencing apart, and move the cylinder a few feet away from the pile. Then fork the materials from the pile into the empty wire cylinder.

TIP

How often you turn the pile and how quickly the compost is done depend on how quickly decay takes place. For example, green, succulent organic material — such as fresh grass clippings — decays faster than dried plant material; cool fall temperatures or a spell of rainy days that turn the pile soggy slow things down. Follow these guidelines for deciding when to turn your pile:

- If you added only shredded material, the pile may be ready for turning in a week.
- If the pile contains a lot of big pieces of organic material, wait several weeks before turning.
- If the pile heats up and then cools, turn it.
- Turning the pile two to three times throughout the process is plenty.

You can tell that decay has set in if your pile starts to smell bad. If smells occur, hold your nose and fix things by spreading out the pile and reconstructing it.

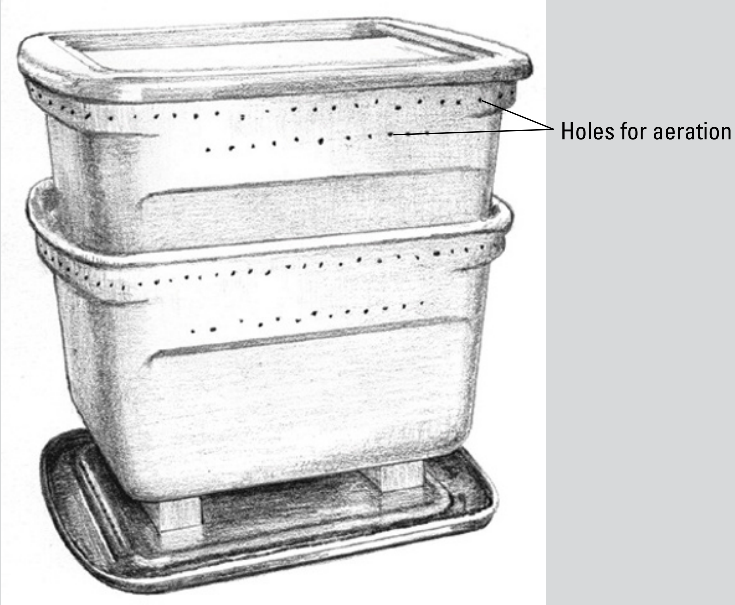
Your compost is ready for use when the interior of the pile is no longer hot and all the material in the pile has broken down into a uniform, dark crumbly substance; this process takes about 1 to 2 months. To determine whether the pile is no longer hot, feel the interior of the pile with your hand. If you're squeamish, use a compost thermometer (which is available at garden centers).

WORKING WITH WORMS AS COMPOSTING COMPANIONS

Vermicomposting is a composting method that employs certain worm species to consume and convert organic matter into a useful soil amendment and organic fertilizer. *Castings* (a refined term for worm poop) resemble grains of black soil or coffee grounds. In your worm bin, castings blend with partially decomposed food scraps and worm bedding to form *vermicompost*.

Vermicompost has many benefits similar to those of "regular" compost, and can contain up to 11 times more calcium, magnesium, nitrogen, phosphorus, and potassium than plain soil. When added to soil, vermicompost improves aeration, water retention, porosity, and microbial activity. Vermicompost also suppresses diseases in plants and enhances plant growth.

Only a few worm species, such as the red wiggler, are suitable for vermicomposting, and should be purchased from worm suppliers rather than obtained from bait shops or dug up from the yard. Many practitioners of vermicomposting house their worms in a bin made from a pair of plastic storage totes (shown here) with one lid used as a drip tray and with aeration holes drilled in the sides. The bins are filled a foot deep with moist bedding comprised of native soil, newspaper, or cardboard. Food scraps are then added regularly; the worms will eat half their body weight daily. Every four months or so, the bedding is changed and the castings are harvested for use in the garden just like conventional compost.



Fertilizing Your Vegetable Garden

Even if you have the healthiest soil around, growing vegetables is an intensive process that strips many important nutrients from the soil. So you need to add some fertilizer to your soil to keep it in optimum shape to feed your plants.

How much fertilizer you add depends on the soil and the plants you're growing. So it's difficult to generalize across the board on what type of fertilizer to choose and how much to apply. Soil tests are a great way to know what to add. Refer to Chapter 3 of this minibook for more on soil tests.

Examining a fertilizer label

REMEMBER

Commercial fertilizers are labeled with three numbers that indicate the fertilizer's nutrient content (see Figure 5-2). The first number indicates the percentage of nitrogen (N), the second number shows the percentage of phosphate (the type of phosphorus, P2O5), and the third number represents the percentage of potash (the form of potassium used, K2O).

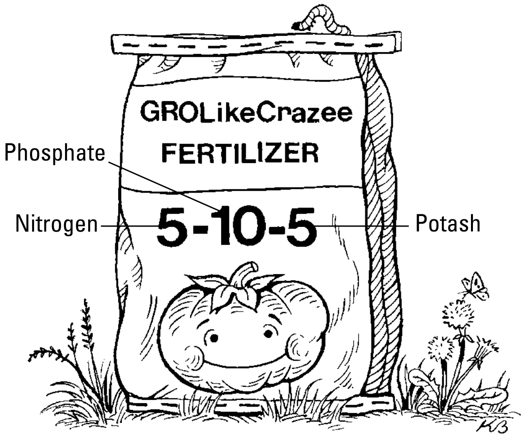


FIGURE 5-2: A fertilizer bag is labeled with nutrient content.

TIP

When talking fertilizer, the abbreviation is NPK. A good way to remember what the NPK numbers refer to is the saying, *"Up, down, and all around:"*

- **N:** Nitrogen, the first number, helps the top growth, or what the plant sends *up*.
- **P:** The second number is for the amount of phosphorus in the mix, and it deals with root growth, or what the plant sends *down*.

- **K:** The final number represents potassium, which deals with the general health of the plant or the *all-around* health.

For example, a 5-10-5 fertilizer contains 5 percent nitrogen, 10 percent phosphate, and 5 percent potash, and it's called a *complete fertilizer* because it contains some of each type of nutrient. In contrast, bone meal has an analysis of 4-12-0. It's a good source of phosphate for root growth but doesn't provide any potash for the plant's all-around health.

Choosing a fertilizer

Most home gardeners can grow a perfectly beautiful and productive garden using organic principles. In the last 20 years, an explosion of organic products (such as fertilizers) has hit the market, making gardening with this method much more accessible.

Organic fertilizers

Organic fertilizers — animal and green manure, blood meal, fish emulsion, cottonseed meal, granite dust, and rock phosphate — have several advantages:

- Many organic fertilizers contribute organic matter to your soil, improving its structure, feeding soil microbes, fighting fungal and bacterial diseases, and contributing micronutrients.
- Most organic fertilizers supply a slow but steady diet for plants.
- Some organic fertilizers, such as manure and compost, may be inexpensive — or free if you create them yourself.
- Complete organic fertilizers, such as 5-5-5, are now more widely available and have higher concentrations of nutrients than in the past, making them easy-to-use alternatives to chemical fertilizers.

WARNING

However, it's not all sun and roses when using organic fertilizers. Here are some disadvantages:

- Some organic fertilizers, such as manures and compost, are bulky and difficult to store and transport.
- Their slow release of nutrients, in some cases dependent on the action of soil microorganisms, may take too long to remedy a dire situation when an adequate nutrient supply is needed.

- Many organic fertilizers are lower in nutrient content than their chemical equivalents, and the contents may vary depending on the weather and conditions where the fertilizers were produced. So you may not be exactly sure how much to put on your garden.

Chemical fertilizers

Chemical fertilizers are synthetically manufactured. They include elements such as sodium nitrate, potassium chloride, and superphosphate. Chemical fertilizers come in liquid, granular, powder, or pellet form. You can fertilize when you water with a watering can, using a liquid fertilizer. Or you can sprinkle some granular fertilizer around each plant.

WARNING

Chemical fertilizers are widely available, less expensive than organic fertilizers, quick acting, and easy to use, but many believe that the disadvantages of using chemical fertilizers far outweigh the advantages. Here's why:

- **Chemical fertilizers add no organic matter to your soil and contribute nothing to improving soil structure.** In fact, some research suggests that chemical fertilizers actually harm the microorganisms in the soil, making the soil less able to support long-term plant growth.
- **Chemical fertilizers are concentrated and fast acting, but they have no long-term benefits for your soil.** It's like taking a vitamin for your health versus eating a good meal.
- **Manufacturing chemical fertilizers requires large amounts of energy, usually supplied by nonrenewable resources.** This massive use of energy increases pollution, global warming, and our carbon footprint. Even though some commercial organic fertilizers, such as rock phosphate and green sand, also are manufactured and require energy inputs, home gardeners can instead choose to use locally made compost and manures to get the nutrients they need for their gardens.

Side-dressing

Depending on the crops you grow and the type of soil you have, you may need to add repeat doses of fertilizer throughout the growing season — a practice called *side-dressing.* For example, because sandy soils don't hold nutrients well, giving plants small, regular fertilizer applications ensures a steady supply of nutrients.

Fertilizers and techniques that work well for side-dressing

Granular organic fertilizers, such as 5-5-5, are a good choice for side-dressing most root and fruiting crops. Use 1 to 2 tablespoons per plant, or 1 to 2 pounds for every 25 feet in a row.

REMEMBER

Depending on plant spacing, side-dress either in a narrow furrow down a row or around each individual plant (refer to Figure 5-3). In either case, spread granular fertilizer (which is easier to use than liquid fertilizer) at least 6 to 8 inches away from plant stems. Rake the fertilizer into the soil and then water.

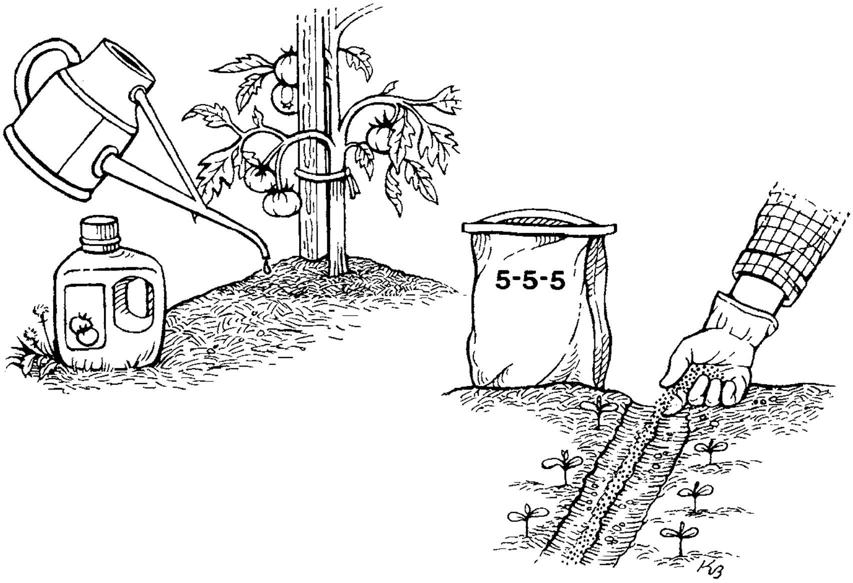


FIGURE 5-3: Ways to fertilize vegetable plants.

TIP

For leafy green crops, fish emulsion is a quick-acting, highly soluble organic source of nitrogen that gives your greens a boost, especially if they're turning a pale green color. You can add micronutrients to this fertilizer by mixing it with seaweed. Add this liquid fertilizer to your watering can following the directions on the label. As you water, pour this solution around the bases of the plants and on the leaves.

Knowing when to side-dress

WARNING

Too much fertilizer can be more harmful than too little. Excess fertilizer accumulates in the soil in the form of salts and damages plant roots. So be sure that growing conditions enable plants to use the fertilizer that you apply. For example, don't add fertilizer during a dry spell if you can't irrigate your garden, because without adequate soil moisture, roots can’t take up nutrients. And if cool weather causes your plants to grow slowly and need less fertilizer, go easy on the fertilizer until the temperature warms up or you’ll be wasting it.

The kind of plants that you grow makes a difference in how often you side-dress. Plants that take a long time to mature (such as tomatoes and eggplants) and heavy feeders (such as corn) generally benefit more from side-dressing than quick-maturing crops that fix their own nitrogen — such as lettuce, or legumes such as peas and beans. See Table 5-2 for some general side-dressing guidelines.

TABLE 5-2 Deciding When to Side-Dress Your Vegetables

Vegetable	When to Side-Dress
Beans, green	Not necessary
Beet greens	Two weeks after leaves appear
Beets	When tops are 4 to 5 inches high; go light on nitrogen, which encourages leaf growth
Broccoli	Three weeks after transplant; go light on nitrogen
Brussels sprouts	Three weeks after transplant; again when sprouts begin to appear
Cabbage	Four to six weeks after planting
Carrots	Three weeks after plants are well established and no longer seedlings
Cauliflower	Four to six weeks after planting
Celery	Three weeks after setting out; again six weeks later
Corn, sweet	Three weeks after planting; again when plants are 8 to10 inches high; again when tassels appear
Cucumbers	When they first begin to *run* (form vines and sprawl); again when blossoms set
Eggplant	Three weeks after planting
Kale	When plants are 6 to 8 inches tall
Lettuce, head	Three weeks after transplant; again when heads form
Lettuce, leaf	Three weeks after germination
Melons	When they begin to run; again a week after blossom set; again three weeks later
Onions	Three weeks after planting; again when tops are 6 to 8 inches tall; again when bulbs start to swell
Peas, English	Not necessary

(continued)

TABLE 5-2 *(continued)*

Vegetable	When to Side-Dress
Peppers, sweet and hot	Three weeks after transplant; again after first fruit set
Potatoes	When plants bloom
Pumpkin	When plants start to run; again at blossom set
Radishes	Not necessary
Spinach	When plants are about 3 to 4 inches tall
Squash, summer	When plants are about 6 inches tall; again when they bloom
Squash, winter	When plants start to run; again at blossom set
Swiss chard	Three weeks after germination
Tomatoes	Two to three weeks after transplant; again before first picking; again two weeks after first picking; go light on nitrogen

Keeping Your Plants Cozy and Weed Free with Mulch

Mulch is any material, organic or inorganic, that you place over the surface of soil, usually directly over the root zone of growing plants. It has many benefits depending on the type used. Mulch suppresses weeds, holds in moisture, modifies soil temperature, lessens the chances of certain diseases attacking your plants, and adds an attractive look to your garden.

REMEMBER

Some people use compost as a mulch, but remember that compost has a different purpose than mulch. Compost is added and mixed into the soil to add nutrients and increase the workability of soil (water-holding capacity, aeration, and so on). Mulch generally doesn't add nutrients, but it helps hold in the ones already in the soil and prevents undesirables from attacking your growing plants.

You can choose from two basic types of mulch: organic and inorganic. For vegetable growers, each type of mulch has a unique purpose, as described in the following sections.

Spreading organic mulch

Organic mulch can include grass clippings, compost, leaf mold, pine needles, shredded bark, nut shells, cotton gin waste, straw hay, grain and fruit byproducts, composted manure, mushroom compost, peat moss, and sawdust. Some of these mulches are easier to find in different parts of the country. You can even use newspaper as an organic mulch; black-and-white newspaper print is perfectly safe to use in your garden, and most colored inks are soybean based and biodegradable.

REMEMBER

Generally, a 2- to 4-inch layer of organic mulch, spread evenly on the ground beneath your plants, is sufficient. However, you may have to replenish the mulch during the growing season, especially in hot summer areas, because many organic mulches break down quickly.

Using organic mulch in your vegetable garden has many benefits:

- Organic mulch conserves water by reducing the soil temperature and evaporation. It also keeps the soil cool by buffering direct sunlight.
- It prevents wild fluctuations in soil moisture levels that can really spell disaster in hot weather.
- It smothers weed seeds and prevents them from germinating. Any weeds that do come up in loose mulch are easy to pull.
- As the mulch breaks down, it adds nutrients and improves the texture of the soil that it covers.
- Organic mulch looks good and makes the ground tidy and clean.

WARNING

The following list includes some of the downsides of organic mulches. As minor as they are, they may lead you to choose one type of organic mulch over another:

- **Bark mulches, such as pine, are quite acidic.** So if you use them, keep a close eye on the pH level of your soil and correct it accordingly. Avoid the trendy artificially colored mulches around veggies, because they may contain potentially harmful chemicals that can leach into your soil.
- **Grass clippings decay quickly and must be replenished often.** Fortunately, grass clippings are usually pretty abundant. But if the grass goes to seed before you cut it, you may end up with grass growing in your vegetable garden. Also, make sure that no *herbicides* (weed killers) have been used on your lawn because the residue can damage or kill vegetables; if you have your lawn treated regularly, use another type of mulch. Likewise, hay mulch often has weed seeds in it, so use cleaner straw mulch if available.

- **Some organic mulches — such as fresh sawdust — rob nitrogen from the soil as they break down.** You may have to add supplemental nitrogen to your vegetables if they grow mysteriously slow or start to turn yellow.
- **Some organic mulches, such as peat moss or leaves, can pack down or get hard and crusty when exposed to weather.** Water may not penetrate these mulches, running off the soil instead of soaking into the roots. Avoid peat moss; or at least mix it with another organic mulch such as sawdust.
- **Some lightweight mulches, such as straw or cocoa hulls, can blow around in the wind.** You may want to avoid them if you live in a windy area.
- **Organic mulch, which keeps the soil cool, may slow the growth and maturity of warm-season crops such as tomatoes and melons.** This cooling can be especially problematic in areas with cool summers. However in very hot-summer areas of the country, organic mulches work to keep the roots of even warm-season crops cool and healthy.
- **Composted manures may burn young vegetables if used as mulch because the manures vary in the amount of nitrogen they contain.** If you want to use composted manure, mix it with three times the volume of another organic mulch before applying it.

You can purchase organic mulches such as shredded bark, compost, and leaf mold in bags or sometimes in bulk from nurseries and garden centers. Grass clippings, compost, and wood chips come free from your yard or garden.

Laying inorganic mulch

Inorganic mulch includes things such as plastic, landscape fabric, and believe it or not, old carpet. I explain how to use all types of inorganic mulches in the following sections.

Plastic

REMEMBER

Plastic is the most-used inorganic mulch for vegetable gardens. Mulching with plastic (see Figure 5-4) works best when you install drip irrigation or a soaker hose underneath the plastic before planting. Otherwise, watering is difficult. (You can place the irrigation on top of the plastic, which enables you to more easily check for clogs, but you have to run individual emitters to each plant.) Plastic doesn't work well with vegetables planted very close together, such as root crops.

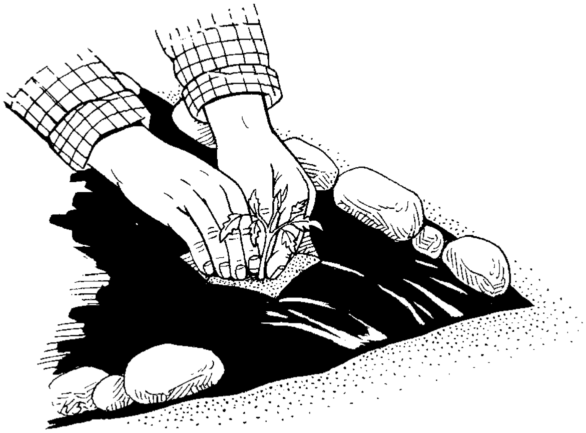


FIGURE 5-4: Planting in black plastic mulch.

TIP

The color of plastic mulch you use depends on what you're growing. Some vegetables grow better with certain colored plastics. For example:

- **Red:** For growing tomatoes, eggplants, and strawberries
- **Dark green or IRT (infrared transmitting)**: For growing melons
- **Silver:** For growing peppers
- **White:** For hot climates where you want to stop weeds from growing but not heat up the soil
- **Black:** For weed control and warming soils, and for growing many vegetables, including cucumbers and squash

To mulch with plastic, follow these steps:

1. **Purchase rolls or sheets of 2- to 4-millimeter plastic (the thicker the better).**

   You can find the thickness of the plastic on its label. Purchase plastic at garden centers or hardware stores, or check the appendix for sources of various colored mulches.

2. **If you're using irrigation under the plastic, lay down your drip irrigation and turn it on for several hours.**

   Note where the wet spots are in the soil. Adjust the drip hose so water doesn't pool in certain areas, but is evenly distributed. See the earlier section on drip irrigation for more details on installing this type of watering system.

3. **A week or two before planting, water the entire area with a hose or sprinkler so it's wet to 6 inches deep.**

   Roll out the plastic over the planting area and cover the edges of the plastic with soil.

4. **Cut holes in the plastic where you want to plant your transplants.**

   You can sow seed this way as well; just make sure that the seed can get through the holes in the plastic after it germinates.

5. **Plant your seeds or transplants in the holes.**

   Make sure you plant in wet spots; otherwise, the plants may not get enough water.

TIP

If you live in a climate that gets very hot in the summer (Texas, for example), after the weather starts to warm, you may want to cover black plastic with an organic mulch to prevent the soil from getting too warm. Or consider using white plastic instead.

Unless you have a problem with the irrigation system, you usually don't have to remove the plastic until the end of the season.

Other inorganic mulches

Beside plastics, you also can use the following inorganic mulches in your vegetable garden:

- **Cardboard:** Even though it's biodegradable, cardboard takes so long to decompose that I treat it as an inorganic mulch. You can cut cardboard boxes to fit in pathways. If you don't like their look, cover them with hay or straw.
- **Landscape fabric:** This inorganic mulch doesn't warm the soil as much as black plastic, but it's permeable, enabling you to water through it. It also does a good job of keeping down weeds. You can find landscape fabric at your local nursery. You apply landscape fabric the same way that you do plastic (see the preceding section).
- **Rug strips:** Roll out 3-foot rug strips and place them nap side down, leaving about 6 inches of open soil between strips for irrigation and planting. Even though rug strips look pretty weird in a garden, they keep the weeds down and make a nice path.

Deciding which mulch to use

Choosing a mulch and deciding when to use it in your vegetable garden depends on the type of vegetables that you grow and when you plant them. Check out these mulching tips for different types of vegetables:

- **Cool-season vegetables planted in early spring:** You want the sun to warm your soil in the spring because lots of sun helps young plants get off to a fast start. Here are a few mulching pointers for these vegetables:

  - Lay down organic mulch when the soil starts to warm and when the plants need regular water. If you mulch too early, the soil stays too cold and wet for proper root growth.
  - In areas with short growing seasons, you can plant broccoli, cauliflower, and cool-season plants through plastic. Cover the plastic with organic matter when the weather warms to keep the soil cool.
- **Cool-season vegetables planted in late summer or early fall:** With these vegetables, you want the cooling effect, so put down an organic mulch right after planting. Here are a few other things to keep in mind:
  - When the weather starts to cool, rake off or remove the organic mulch so the soil warms.
  - You can plant through plastic late in the year, but you should cover it with an organic mulch immediately so the soil doesn't get too hot. Then remove the organic mulch when the weather cools and let the plastic warm the soil through harvest.
  - Many root crops can be stored in the ground well into winter if you cover them with a thick organic mulch such as straw. Applied before the ground freezes, the mulch keeps the soil loose and unfrozen so you can dig the vegetables later into winter.
- **Warm-season vegetables planted in spring:** With these vegetables, keep the ground clear if you're planting really early — the more heat the better. Planting through plastic works in early spring. In hot climates, apply an organic mulch when the weather starts to get really warm in summer.

Surveying Some Cool Farmer Techniques

Over the years, farmers, and even gardeners for that matter, have tried almost anything to get better, bigger, and earlier harvests. Some of these techniques, such as planting according to the cycles of the moon, are rooted more in mysticism than in hard science. Others, such as using cover crops and succession planting, are commonsense approaches to farming that are now established practices in modern agriculture. They may also be useful (or just fun) techniques for homesteaders.

Adding nutrients and stability with cover crops and green manures

A *cover crop* is a general term for any plant grown to prevent erosion, improve soil structure, and maintain soil fertility. Sometimes, you'll hear cover crops referred to as *green manures*. Green manures are cover crops that are used primarily to add nutrients to the soil and are tilled into the soil when they're still green. Green manures are the most useful cover crop for vegetable gardeners.

REMEMBER

The advantages of using cover crops are impressive:

- **They add organic matter to the soil.** By adding this matter to the soil, you improve water retention, aeration, and drainage.
- **They prevent erosion.** Cover crops prevent erosion by holding soil in place in windy or wet areas.
- **They loosen compacted soils.** Certain cover crops, such as oilseed radish and bell beans, have aggressive *taproots* (roots that grow deeply into the soil), sometimes reaching 3 feet deep, that help break up compacted soils.
- **They add nutrients to the soil.** Legume cover crops, such as hairy vetch and crimson clover, through a symbiotic relationship (I scratch your back, you scratch mine) with rhizobium bacteria on their roots, convert atmospheric nitrogen into a type that they can use to grow. The process is called *nitrogen fixing*. When the cover crop is tilled into the soil, the nitrogen is released for the next crop. Also, taprooted cover crops bring minerals to the surface from deep below the soil.
- **They help control weeds.** Cover crops control weeds by shading the weed seeds so they can't grow or by just being more aggressive than the weeds. Some crops, such as buckwheat, actually exude chemicals that inhibit weed growth.
- **They attract beneficial insects.** Many cover crops attract good bugs that prey on garden pests, reducing insect problems on your vegetables.

If you want a healthier, more productive garden, and you have room, include cover crops each year in different parts of your veggie garden. The following sections focus on how to select and plant the best cover crops for your garden.

Choosing cover crops

Cover crops can be *annual* (they die after flowering or overwinter) or *perennial* (they regrow each year). For home gardeners, the best crops to sow are annual cover crops. These are easy to maintain and won't turn your vegetable garden into a cover crop garden.

The most useful annual cover crops for home gardeners are listed here. All but the grasses and buckwheat are nitrogen fixing:

- **Annual ryegrass,** *Lolium multiflorum,* is a fast-growing, easy-to-establish grass that grows 2 to 3 feet high. It's hardy to –20 degrees Fahrenheit but can become weedy. Sow ½ to 2 pounds of seed per 1,000 square feet.

- **Berseem clover,** *Trifolium alexandrinum,* grows 1 to 2 feet high and is easy to mow and till under. It's hardy to 20 degrees. Sow 2 pounds of seed per 1,000 square feet. Crimson clover, *T. incarnatum,* is closely related, grows 18 inches high, and is hardy to 10 degrees. It has pretty red flowers that attract bees.
- **Buckwheat,** *Fagopyrum esculentum,* is fast growing, reaching 3 to 4 feet tall in about 40 days from seeding. It provides lots of organic matter, smothers weeds with its large leaves by shading them out, and exudes chemicals to prevent weeds from germinating. It breaks down quickly in the soil after tilling. Sow 3 pounds of seed per 1,000 square feet. Buckwheat doesn't fix nitrogen and is frost sensitive, so grow it in summer when the temperatures are warm.
- **Fava beans,** *Vicia faba,* grow 3 to 8 feet high and are hardy to 15 degrees. Bell beans are a shorter (3 feet) relative. Edible varieties include 'Sweet Loraine' and 'Windsor'. Sow 2 to 5 pounds of seed per 1,000 square feet.
- **Field peas,** *Pisum arvense* or *P. sativus,* come in several varieties that range in height from 6 inches to 5 feet high. They're hardy to 10 to 20 degrees. Sow 2 to 4 pounds of seed per 1,000 square feet.
- **Hairy vetch,** *Vicia villosa,* is the hardiest annual legume (–15 degrees) and grows about 2 feet high. Sow 1 to 2 pounds of seed per 1,000 square feet.
- **Winter rye,** *Secale cereale,* is a very hardy grass (–30 degrees) that grows 4 to 5 feet high. It's the best grass for cold areas with poor, acidic soils and produces lots of organic matter. Sow 2 to 3 pounds of seed per 1,000 square feet.

Planting cover crops

The best time to plant cover crops is late summer to early fall. What happens next depends on the climate where you live:

- **In mild-winter areas,** the plants will grow throughout winter and can be turned into the soil in spring.
- **In cold-winter climates,** plant hardy types that will grow for a while in fall, go dormant, and then grow again in spring before eventually dying. Some less hardy types, such as annual ryegrass, will die back in winter and be easier to till under in spring. You can work them into the ground in late spring or early summer and plant vegetables soon after.

  An early spring planting of cover crops also works in cold-winter climates, but you won't be able to work the plants in until later in the summer.

Because beds planted with cover crops won't be available for planting vegetables until you turn them under, you have to plan ahead to use your garden efficiently. If you're short on space, consider alternating vegetables and cover crops so that each bed gets a cover crop every two or three years instead of each year.

TIP

If you plant cover crops in fall after your vegetables are done, you won't miss a beat and can plant vegetables again in spring. If you plant cover crops during the spring or summer, you'll have to sacrifice some space in your veggie garden. Opt for this route only if your soil is very poor and you need to build it up while growing vegetables at the same time. Just rotate where you plant the cover crops in your garden, and after a few years, your whole garden will get a cover cropping.

Plant cover crops by broadcasting seed. To make sure the proper bacteria are present for nitrogen fixing in legume cover crops, use an inoculate. Most suppliers sell an inoculate that you mix with the seed. Till the soil, sow the seeds, and lightly cover the seeds with soil. If the weather is dry, water the seedbed to get the plants off to an early start and then keep the soil moist until it rains.

REMEMBER

If you grow cover crops up to planting time (spring or fall) in your garden, the best time to work the cover crops into the ground is just before they start to bloom. With taller types, you may have to cut or mow the plants down before turning or tilling them in. After you work them in, wait about two weeks before planting vegetables.

Making your garden work double time with intercropping

Intercropping is a space-saving technique in which you grow fast-maturing, smaller crops among slower-growing, larger vegetables. By the time the bigger plants start to take over, you have already harvested the crops in between. Intercropping makes one bed as productive as two.

TIP

The best crops for intercropping include beets, carrots, lettuce, onions, radishes, spinach, and turnips. Use these examples to help you decide how to do it:

- Plant lettuce, carrots, or radishes among young tomatoes and broccoli. For that matter, plant carrots and radishes wherever you have open space.
- Plant turnips and other root crops among your cabbage.
- Plant spinach or lettuce under your bean trellis. As the weather warms, the beans will shade the spinach and keep it cool.
- Plant green onions between rows of corn.

Succession planting for an extended harvest

Succession planting is a method of extending the harvest of vegetables, such as radishes and corn, that ripen all at once and lose quality if left in the garden instead of being harvested. Farmers use the technique to ensure a constant supply of vegetables to take to market; you can use it to produce a consistent supply of vegetables to take to your table. To succession plant, you simply make smaller plantings separated by two to three weeks instead of planting everything at once. Some great crops to succession plant are lettuce and greens, bush beans, beets, carrots, onions, radish, spinach, and sweet corn.

REMEMBER

If you want to experiment with succession planting, use these steps:

1. **Figure out how much of a certain vegetable your family needs for a two- to three-week period and how much room it will take to grow it.**

   Figure 5-5 shows a sample garden plan for succession planting. Check out Chapter 1 of this minibook for additional information on how to plan your garden.

2. **Break your planting beds into three or four appropriate-sized sections to grow your two- to three-week supply of the vegetable.**
3. **At the start of the planting season, plant the first bed; wait about two weeks and plant the second bed, and then plant the third bed about two weeks later.**

   Just about the time you finish harvesting the first bed, the second bed will be ready to harvest.

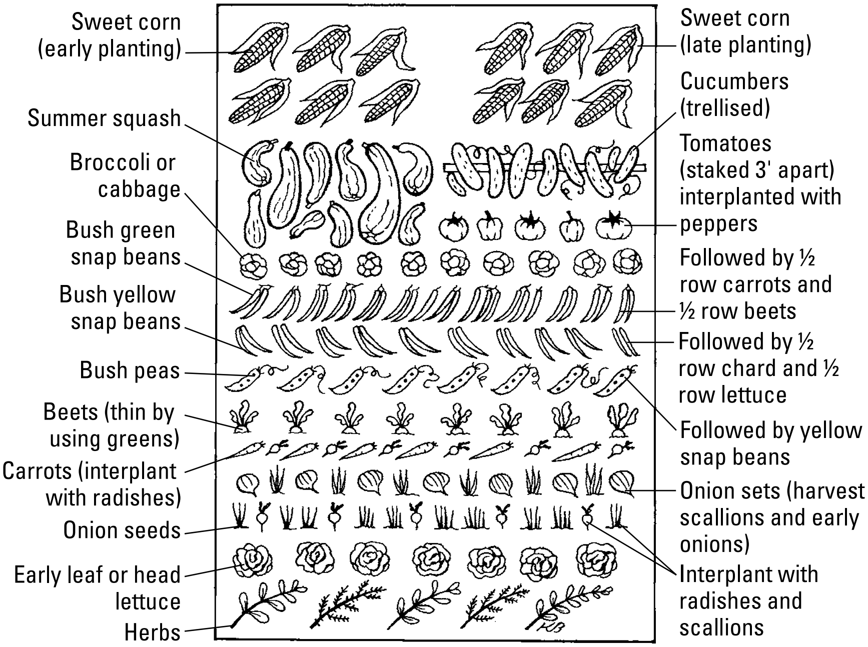

Sweet corn (early planting)
Summer squash
Broccoli or cabbage
Bush green snap beans
Bush yellow snap beans
Bush peas
Beets (thin by using greens)
Carrots (interplant with radishes)
Onion seeds
Early leaf or head lettuce
Herbs
Sweet corn (late planting)
Cucumbers (trellised)
Tomatoes (staked 3' apart) interplanted with peppers
Followed by ½ row carrots and ½ row beets
Followed by ½ row chard and ½ row lettuce
Followed by yellow snap beans
Onion sets (harvest scallions and early onions)
Interplant with radishes and scallions

FIGURE 5-5: A sample plan of succession plantings.

The length of your planting season will determine how many successive plantings you can make and how successful the later plantings are. Depending on the weather, some of your later plantings may not yield well, but that's another reason to plant a number of plantings through the season: you're sure to get some of every type of veggie.

Another way to use succession planting is to replace a crop that's finished producing with a new one in the same place. With this method, you can grow more and a wider variety of vegetables in a small space. Just make sure you're planting a cool-season veggie for spring or fall and a warm-season veggie for summer. Table 5-3 lists some good succession planting combinations to try. You can choose one veggie from each column to plant in succession.

TABLE 5-3 Succession Planting for Different Seasons

Spring	Summer	Fall
Spinach	Bush beans	Kale
Mesclun greens	Cucumber	Lettuce
Peas	Sweet corn	Collards
Radish	Eggplant	Chinese cabbage

Yet another way to ensure a constant harvest of vegetables is to plant using the *square foot method.* This method is for the mathematically inclined (even though you don't need an A in calculus to use it). You select a 4-foot-by-4-foot section of your garden and divide it into 16 squares (each section is 1 square foot). Each square will have a different number of plants, depending on what you're growing:

- **1 plant per square:** Tomatoes, peppers, broccoli, cabbage, cauliflower, eggplant, corn, melon, squash
- **4 plants per square:** Lettuce, garlic, Swiss chard
- **8 plants per square:** Pole beans, peas, spinach
- **16 plants per square:** Beets, carrots, radishes, onions

By planting so few plants, you'll have many small harvests, and you can easily make more succession plantings and rotate plantings each year. (Crop rotation is described in Chapter 6 of this minibook.)

Planting by the phases of the moon

Planting by the phases of the moon isn't just a New Age technique. It has been used for eons by many ancient farmers and gardeners. They noticed that certain vegetables perform better when planted during different moon phases. The planting seasons don't really change, but planting dates during those seasons become very important.

Here's how moon gardening works: If you divide the 28-day moon cycle (from the new moon to the full moon and back to the new moon) into quarters, as any calendar does, certain quarters are thought to be better than others for planting specific vegetables. The following list gives you an idea of what to plant when, according to the moon cycle:

- **The first quarter,** when the moon goes from new moon (invisible) to a quarter visible, is thought to be best for planting asparagus, lettuce, broccoli, cabbage, cauliflower, and other vegetables that produce their seeds on parts of the plant that aren't eaten.
- **The second quarter,** when the moon goes from half to full, is best for planting vegetables in which the seeds are eaten, such as beans, tomatoes, peppers, and squash.
- **The third quarter,** as the moon moves from full back to half again, is best for planting root crops such as beets, carrots, potatoes, radishes, and turnips.
- **The last quarter,** when the moon goes from half to invisible, is not thought of as a good planting time. Instead, it's a time to prepare the soil and rid the garden of pests and weeds.

Knowing When to Harvest

You should harvest most vegetables when they're young and tender, which often means harvesting the plants, roots, or fruits before they reach full size. A 15-inch zucchini is impressive, but it tastes better at 6 to 8 inches. Similarly, carrots and beets get *woody* (tough textured) and bland the longer they stay in the ground. Table 5-4 provides specific information on when to harvest a variety of veggies.

Other plants are continuously harvested to keep them productive. If you keep harvesting vegetables such as snap beans, summer squash, snow and snap peas, broccoli, okra, spinach, and lettuce, they'll continue to produce pods, shoots, or leaves.

TABLE 5-4 Harvesting Fresh Vegetables

Vegetable	When to Harvest
Asparagus	When spears are 6 to 9 inches long
Beans, snap	Start about two to three weeks after bloom, before seeds mature
Beans, dried	When the pods are dry and crack open easily
Beets	When 1 to 3 inches wide
Broccoli	When flower heads are tight and green
Brussels sprouts	When sprouts reach 1 inch wide
Cabbage	When heads are compact and firm
Carrots	When tops are 1 inch wide
Cauliflower	While heads are still white but not *ricey* (the florets are splitting apart)
Celery	When stalks are large enough to eat
Corn	When silks are dry and brown; kernels should be milky when cut
Cucumbers	When 6 inches long for slicking; when at least 2 inches long for picklers
Eggplant	Before color dulls; flesh should bounce back when pressed lightly
Garlic	Pull up stalks when the bottom leaves yellow
Kohlrabi	When 2 to 3 inches wide
Leeks	When the stalks are at least 1½ inches in diameter
Lettuce and other greens	While leaves are tender
Muskmelons	When fruit slips off vine easily; while *netting* (raised area on skin) is even; when fruit is firm
Okra	When pods are soft and 2 to 3 inches long
Onions	When necks are tight and scales are dry
Parsnips	When roots reach desired size, possibly after light frost
Peanuts	When leaves turn yellow
Peas	While pods are still tender
Peppers	When fruits reach desired size and color
Potatoes	When vines die back
Pumpkins	When shells harden, before frost
Radishes	When roots are up to 1¼ inches wide

Vegetable	When to Harvest
Rhubarb	When it shows red streaks on the stalks
Rutabagas	When roots reach desired size
Shallots	When tops wither and turn brown
Spinach	When leaves are still tender
Squash, summer	When 6 to 8 inches long
Squash, winter	When shells harden, before frost
Sweet potatoes	When they reach adequate size
Tomatoes	When uniformly colored
Turnips	When 2 to 3 inches wide
Watermelons	When undersides turn yellow and produce a dull sound when thumped

TIP

A good rule for many of your early crops is to start harvesting when you have enough of a vegetable for a one-meal serving. Spinach, Swiss chard, scallions, radishes, lettuce, and members of the cabbage family certainly fit the bill here. These veggies don't grow as well in warm weather, so pick these crops in the spring when temperatures are cooler.

After you start harvesting, visit your garden and pick something daily. Take along a good sharp knife and a few containers to hold your produce, such as paper bags, buckets, or baskets. Wire or wood buckets work well because you can easily wash vegetables in them.

TIP

The harvesting information in Table 5-4 is based on picking mature or slightly immature vegetables. But many vegetables can be picked smaller and still have excellent flavor. Pick baby vegetables whenever they reach the size that you want. The following vegetables can be picked small: beets, broccoli, carrots, cauliflower, cucumbers, lettuce and other greens, onions, peas, potatoes, radishes, snap beans, summer squash, Swiss chard, and turnips. In addition, some small varieties of corn and tomatoes fit the baby-vegetable mold.

WARNING

Be sure to avoid harvesting at the following times:

- **When plants, especially beans, are wet.** Many fungal diseases spread in moist conditions, and if you brush your tools or pant legs against diseased plants, you can transfer disease organisms to other plants down the row.

- **In the heat of the day, because the vegetable's texture may be limp.** For the freshest produce, harvest early in the day when vegetables' moisture levels inside the vegetables are highest and the vegetables are at peak flavor. After harvesting, refrigerate the produce and prepare it later in the day.

In the fall, wait as long as you can to dig up root crops, such as carrots, rutabagas, and beets, if you intend to store them in a root cellar or cold storage room. However, remember that while root crops can withstand frosts, you should harvest them before the ground freezes. They'll come out of the ground easiest if the soil is still slightly moist. Also, don't wash crops that are going to the root cellar; instead, just gently brush away soil crumbs. Use any blemished or cut vegetables within a few days.

IN THIS CHAPTER

- **Fighting weeds the smart and natural way**
- **Identifying garden pests and safeguarding your crops**

Chapter 6

Dealing with Weeds and Pests

You put a lot of work *into* your garden. But a sizable portion of any gardener's workload involves taking certain things *out*. You've created a healthy and productive environment intended to support life, and now life is literally bursting forth in your garden beds: not only in the form of your fruits and vegetables and herbs but also with the unwanted plants and predatory insects that inevitably follow.

Weeds and pests are two unfortunate facts of life that every gardener must face. They can devour valuable resources — water, soil nutrients, blossoming plants, and your time, money, and energy — that would otherwise be furthering the things you want your garden to produce. But don't let the unpleasant reality of weeds and pests discourage your homesteading efforts. After all, they're just part of the arrangement you‘ve signed up for by working with Mother Nature.

This chapter spells out techniques and tactics for dealing with weeds and pests, including knowing which bugs you should be inviting into your garden.

Fighting Weed Wars

A *weed* is any plant that's growing where you don't want it to. Some weeds are worse than others, but in general, you don't want any weeds in your vegetable garden because they compete with vegetables for light, water, and nutrients. If you have a lot of weeds, you'll have weaker plants and a less substantial harvest. Besides, weeds look terrible.

The key to battling weeds is to get to them early before they're firmly established. When they're young, weeds are easier to pull, easier to till under, and less likely to produce seeds that cause problems down the road.

Making a preemptive strike on weeds

You can reduce weeds in your vegetable beds many different ways. Here are some things that you can do before planting your garden:

- **Presprout weed seeds.** *Presprouting* — forcing weed seeds to germinate before you plant so you can kill them early — really cuts down on the number of weeds in your beds. Follow these steps:

  1. **Prepare your planting bed several weeks before you're ready to plant.**

     Refer to Chapters 2 and 3 of this minibook for details on planning and preparing your beds for planting.

  2. **Water the soil well and wait a few days.**

     Presto, young weeds begin popping up.

  3. **Kill the weeds.**

     You can choose to kill the weeds one of two ways: pull them out by hand, or rake the bed lightly to uproot the seedlings and then let them dry out to die.

  However you get rid of the young weeds, disturb the soil as little as possible when you do it; otherwise, you'll bring more seeds to the surface.

REMEMBER

- **Plan for easy weeding.** Leave enough room between rows so you can weed the soil easily.

- **Solarize the soil.** When you *solarize* the soil, you use the power of the sun to kill weeds. This technique works best in the middle of summer in hot climates such as Arizona and Florida. The only downside to solarizing is that it takes a while. Follow these steps to solarize your soil:

  1. **Prepare your bed for planting and water it well.**

  2. **Dig a 6-to-12-inch-deep trench around the perimeter of the bed.**

3. **Cover the entire bed with thick clear plastic (4 millimeters) and place the edges of the plastic in the trenches and fill the trenches with soil. Then wait.**

   The temperature gets so hot underneath the plastic that it kills insects, disease organisms, and weeds. It usually takes a few months of solarizing to get a beneficial effect.

- **Plant your vegetables at the proper time of year.** That way, they get off to a fast start, and weeds have a harder time catching up with them. See Chapter 4 of this minibook for details.

Battling weeds after planting

If (or when) you come across weeds after you plant your crops, you have several choices for eliminating them:

- **Mulch your beds.** Applying a layer of thick organic mulch is one of the best ways to battle weeds. Even if mulch doesn't smother the weeds and their seeds, the weeds that do come up are easy to pull. Planting through plastic is also an effective way to keep weeds from becoming a problem. See Chapter 5 in this minibook for more information.
- **Pull the weeds by hand.** While they're young, weeds come out of the ground easily. Get 'em roots and all, whenever you see them. If you can't pull out the roots by hand, use a trowel.
- **Cultivate the soil.** Simply hoeing or lightly turning the soil between vegetables exposes the weeds' roots and kills many of them. Cultivating is most effective when you do it often (a few times a week in the first month or so of gardening) and early, when the weeds are small.
- **Keep garden paths clean.** Try to keep your garden paths as weed free as possible; otherwise, weeds will creep into your planting beds. Try covering the paths with a thick mulch to keep weeds from becoming established.
- **Make sure the areas around the garden are weed free.** If you're growing vegetables near a field or weedy woodland edge, try to mow a wide strip between your garden and the field so the weed seeds can't blow in as easily. It won't stop all of them, but every little bit helps.

Using herbicides smartly

When all else fails, gardeners can turn to herbicides to kill the weeds. Generally speaking, homesteaders growing food for their family and raising animals are loathe to introduce toxic chemicals in their garden, for obvious reasons. But the word *chemical* doesn't have to refer to a harmful poison that kills your prized crops right along with the weeds being targeted. As with any chemical treatment — organic or synthetic — use the most powerful ones only as a last resort.

Herbicides work in several ways that depend on a particular plant's life stage or characteristics to be effective:

- **Pre-emergent herbicide:** Sprouting seeds send out roots first, followed by the stem and first leaves. This vulnerable time is the best and easiest stage to knock them out. Pre-emergent herbicides kill these tiny seedlings as they sprout and are especially useful on lawns and in other places where mature weeds are difficult to remove.

  TIP

  One relatively new organic pre-emergent herbicide is corn gluten meal, a highly concentrated corn protein extract. It can control weeds for up to six weeks if applied in early spring and again in late summer. As a bonus, it's high in nitrogen.

- **Herbicidal soap:** Plants have a waxy coating on their leaves that prevents moisture loss. Herbicidal soap damages the waxy layer, allowing the plant to dry out and die. This type of herbicide works best on young, tender, actively growing weeds in hot, dry weather. It's less effective on mature plants and perennial weeds.

  Plants are sensitive to changes in pH. Some products use acetic acid (derived from vinegar) or pelargonic acid (derived from fruit) as their active ingredient. These acids damage the plants' protective waxy coating, killing the sprayed plant parts in a matter of hours.

  WARNING

  Regular kitchen vinegar is only 5 percent acetic acid; though it may kill weed seedlings, it has little effect on mature plants. Commercial formulations of up to 20 percent acetic acid are available. Although these substances are more potent weed-killers, they're also more hazardous to use. Follow label directions, wear gloves and goggles when applying, and store them as you would any other garden chemicals.

These products are acceptable for spot treatments but shouldn't be used extensively because they also kill beneficial organisms and lower soil pH. New formulations made from a combination of vinegar, citrus, cinnamon, or clove oils have been introduced recently.

Keeping Good Bugs Nearby

Most gardens are populated by a huge number of insects, most of which are neither good nor bad. They're just hanging out in your garden at no expense to your plants. But some insects are beneficial, waged in a constant battle with the bugs that are harming your plants.

For most gardeners, the goal is to have a maximum diversity of bugs in the garden. To get the good insects to stick around, follow these tips:

- **Avoid indiscriminately using broad-spectrum chemical or organic pesticides, which kill everything, the good bugs and the bad.** If you do spray, use a spray that specifically targets the pest that you want to eliminate and that has minimal effect on beneficial insects; the label on the spray usually gives you this information. (I discuss safe sprays in detail later in this chapter.)
- **Plant a diverse garden with many kinds and sizes of plants, including flowers and herbs.** Doing so gives the beneficials (beneficial insects) places to hide and reproduce. A garden with a variety of plants also can provide an alternative food source, because many beneficials like to eat pollen and flower nectar, too. Some plants that attract beneficials include Queen Anne's lace, parsley (especially if you let the flower develop), sweet alyssum, dill, fennel, and yarrow.
- **Provide a diverse habitat for beneficial insects.** Have a small bird bath and evergreen and deciduous shrubs to hide in nearby. These elements provide water and shelter for beneficial insects, making it more likely they'll hang around to munch on some insect pests.

Battling Bad Bugs

Despite what you may think, having some bad bugs around is important. Aphids are like hors d'oeuvres for some helpful insects, so it's okay to have a few in your garden. Otherwise, what will the good bugs eat? But accepting the bad bugs also means that you have to accept a little damage once in a while. So just try to manage the pests, not nuke them off the face of the earth. You want to keep them at acceptable levels without letting them get out of control.

It helps to know your enemy, and insect pests command the largest army of invaders. The following sections list the most common insect pests that are likely to infest your vegetables as well as the best ways to control them.

Aphids

Aphids are tiny, pear-shaped pests that come in many colors, including black, green, and red (see Figure 6-1). They congregate on new growth and flower buds, sucking plant sap through their needlelike noses. Heavy infestations can cause distorted growth and may weaken your plants. Aphids leave behind a sticky sap that may turn black with sooty mold and may carry diseases, such as viruses, that infect your plants. Many vegetables can be infested with this pest, including cabbage, cucumbers, and broccoli.

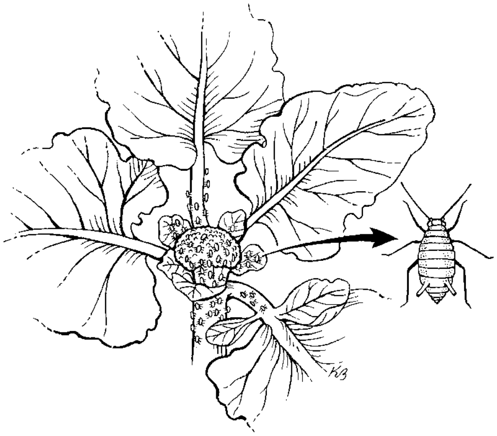


FIGURE 6-1: Control aphids with insecticidal soap, neem oil, or hot pepper spray.

Aphids are easy to control. A strong jet of water from a hose can knock them off sturdy plants (they rarely climb back onto the plant to feed), or you can use insecticidal soap or neem oil. Insecticidal soap also helps wash off the sooty mold. But if you have only a few aphids, wait a week for beneficial insects, especially lady beetles, to move into your garden; they usually take matters into their own hands before serious damage occurs.

Caterpillars and worms

Caterpillars and worms, moth and butterfly larvae, are avid eaters and can cause a lot of damage to a variety of plants. Some are hairy caterpillars; others are smooth skinned and more wormlike. Caterpillars include tomato hornworms and cabbageworms (see Figure 6-2). You can handpick caterpillars and worms to reduce numbers, or you can release trichogramma wasps. But the most effective way to get rid of them is to spray with biological controls, such as Bt (*Bacillus* thuringiensis) or spinosad.

TIP

Sometimes these little guys can blend in quite effectively among your tomato plant's stems and leaves and be hard to spot. Be on the lookout for *frass* — the caterpillar's droppings — on lower stems and leaves. You'll know it when you see it: small black pebbles that may be clumped in barrel-shaped clusters. When you find frass, just search up from there.

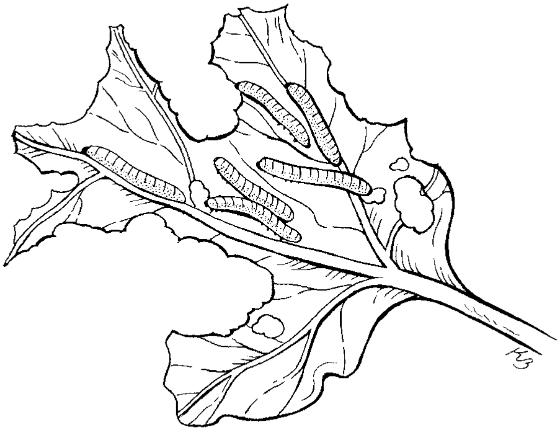


FIGURE 6-2: Handpick the cabbageworm caterpillars that are noshing on your plants or spray with Bt.

Corn earworms

Corn earworms are a common pest wherever corn is grown. These 1½-inch-long caterpillars with alternating light and dark stripes may be green, pink, or brown. In spring, night-flying moths lay yellow eggs on the undersides of leaves. The resulting first-generation caterpillars feed on the leaves. The eggs of later generations can be found on corn silks; the emerging caterpillars feed on the silks and the kernels at the tips of the corn ears, just inside the husks. The earworms, also called fruitworms, attack a variety of plants including tomatoes, beans, peas, peppers, potatoes, and squash.

The easiest way to deal with corn earworms on your corn plants is to just cut off the tip of the ear before you cook it. Or to prevent worms, you can spray Bt before the caterpillars enter the ears or fruit, but that doesn't always work. To prevent the worms from entering the ears, you also can place a few drops of mineral oil on the silks of each ear just as the silks wilt and start to turn from white or yellow to brown. (Don't do it too early or you'll interfere with pollination, but don't wait until the silks are all brown and shriveled either; you have about a week in which to work.)

Cutworms

Cutworms are ½-inch-long, grayish caterpillars. They emerge on spring and early summer nights to eat the stems of young seedlings, causing the seedlings to fall over like small timbers. Cutworms also climb up to older plants and feed on leaves and flowers.

To protect seedlings, surround their stems with barriers that prevent the cutworms from crawling close and feeding. These devices can be as simple as empty cardboard toilet paper rolls, Styrofoam cups with the bottoms cut out, or collars made from aluminum foil. Whatever you use, just make sure that the barriers encircle the stem completely and are set 1 inch deep in the soil. You also can trap cutworms by leaving boards around your garden; the worms hide under the boards during the day, enabling you to collect them. Parasitic nematodes also are effective against cutworms.

Flea beetles

Flea beetles are tiny 1⁄16-inch beetles that feed on vegetable leaves, riddling them with small holes. These beetles jump rapidly when disturbed, like fleas — hence their name. Various species feed on just about any plant in a garden, including eggplant, tomatoes, broccoli, cabbage, corn, potatoes, spinach, peppers, and sweet potatoes. Adult beetles can spread diseases — wilt in sweet corn, for example — and larvae feed on roots. Adults overwinter in the soil and on garden debris, emerging in early spring. Keep a close watch because these beetles can destroy young plants quickly.

To control flea beetles, make sure you clean up garden debris in the winter and till the soil. Use a floating row cover to exclude adults (I describe these covers later in this chapter), and release parasitic nematodes to attack the larvae. Pyrethrins and insecticidal soap also provide some control.

Japanese beetles

Japanese beetles can really be troublesome in many areas. These ½-inch-long beetles have coppery bodies and metallic green heads. They feed on the foliage of many vegetables, including corn, beans, and tomatoes.

WARNING

Controlling Japanese beetles can be tough. Treating your lawn and garden soil with parasitic nematodes or with *milky spore* (a biological spray) may reduce the white C-shaped larvae, but more adults will probably fly in from your neighbor's yard. Floral-scented traps that attract adult beetles are available, but the traps may attract more beetles than you had before. If you try the traps, keep them at least 100 feet from your vegetables and encourage your neighbors to use them, too, to control the beetles community-wide.

Insecticidal soap and neem oil are effective against adult beetles. You also can handpick the beetles off your vegetables and stomp on them. Picking in early morning or evening is easiest because the beetles are sleepy then and tend not to fly away.

Nematodes

Nematodes are microscopic wormlike pests that can infect soil, especially in warm climates. They feed on the roots of plants and attack many vegetables, including carrots, tomatoes, and potatoes. Nematodes thrive in sandy, moist soil and can quickly stunt plants and cause roots to look hairy and knotted. Your best defense is to plant nematode-resistant varieties and to rotate your crops (see Chapter 5 in this minibook) to prevent a population from building.

Snails and slugs

Snails and *slugs* are soft-bodied mollusks that feed on tender leaves and flowers during the cool of night or during rainy weather. Snails have shells; slugs don't. Snails and slugs proliferate in damp areas, hiding under raised containers, boards, or garden debris.

To control these pests, roam through your garden at night with a flashlight and play pick-and-stomp, or trap them with saucers of beer, setting the rims at ground level. They'll jump in to drink the beer, not be able to climb out, and drown. Refill the saucers regularly. Snails and slugs won't cross copper, so you can also surround raised beds or individual containers with a thin copper stripping, which is sold at most nurseries. In California, you can release decollate snails, which prey on pest snails; ask your Cooperative Extension Service office for information.

If all else fails, you can spread snail and slug bait containing iron phosphate. Sold as Sluggo and Escar-Go! this safe bait attracts and kills slugs and snails without being harmful to wildlife, pets, and kids.

Spider mites

Spider mites are tiny, spiderlike arachnids that you can barely see without a magnifying glass. If the population gets big enough, you can see their fine webbing beneath the leaves of your plants. As they suck a plant's juices, the leaves become yellowish with silvery *stippling* (small yellow dots on the leaves) or sheen. If things get really bad, the plant may start dropping leaves. Mites are most common in hot, dry summer climates and on plants with dusty (sooty) leaves. Tomatoes and beans are commonly infested.

A daily bath with a strong jet of water from a hose helps keep infestations down. You can control spider mites with insecticidal soap, which also helps clean off the plants' leaves. Applying summer oil or neem oil and releasing predatory mites also are effective.

Thrips

Thrips are almost-invisible troublemakers. They feed on leaves, giving them a stippled look and deforming them. You can distinguish thrips from spider mites by looking for the small fecal pellets that thrips leave behind. Thrips often pass on diseases as they feed. Beans, cabbage, onions, and eggplants are commonly infested. Many beneficials feed on thrips, especially lacewings. Insecticidal soaps and pyrethrins also are effective.

Whiteflies

Whiteflies look like small white gnats, but they suck plant juices and can proliferate in warm climates and greenhouses. They tend to congregate on the undersides of leaves, especially on tomatoes and beans. You can trap whiteflies with yellow sticky traps, which are sold in nurseries. In greenhouses, release Encarsia wasps, which prey on greenhouse whiteflies. Insecticidal soaps, summer oil, and neem oil are effective sprays.

More Methods of Attack

If the controls mentioned in the previous sections aren't cutting it and you need to take further action, start with the first line of defense against pest outbreaks: physical barriers that keep the bugs away from your plants. The next step is to apply pesticides that are effective against a certain pest, are pretty safe to use, and have a mild effect on the rest of your garden's life-forms. In general, these products are short-lived after you use them in your garden — that's what makes them so good.

Physical controls

You can physically prevent pests from damaging your vegetables a number of ways. One of the best ways is to grab bugs by their tails, body slam them to the ground, and stomp on them. *Handpicking,* as it's usually called, works best with large bugs such as tomato hornworms, Japanese beetles, snails, and slugs. The best time to handpick slugs is at night, using the light of a flashlight. If you have problems squashing bugs, drop them in a jar of soapy water instead.

Here are some other physical controls to try:

- **A strong jet of water** often dislodges insects such as aphids and spider mites from the leaves of vegetables, and they rarely climb back onto the plant. This method also keeps the foliage clean.

- **Barriers** keep pests from reaching your vegetables. For example, place a small copper strip around the outside of raised beds or containers to keep snails from reaching your plants (snails won't cross the copper stripping). *Floating row covers*, those lightweight, blanketlike materials described in more detail in Chapter 6 of this minibook, also keep pests away from plants. And if you have problems with cutworms, push a small cardboard collar (a paper cup with the bottom pushed out works well) into the ground around seedlings to keep bugs from reaching the stems.
- **Trapping** pests before they reach your vegetables is another way to reduce problems. Trapping works best with night feeders — such as slugs and earwigs — that seek shelter during the day and are attracted to dark, moist environments. You can trap snails and slugs under a slightly raised board at night, and then dispose of the board in the morning. Earwigs will collect in rolled-up newspapers.

Safe pesticides

Here are some recommended safe spray methods of controlling harmful bugs:

- **Biological controls:** Using *biological controls* involves pitting one living thing against another. Releasing beneficial insects is one example of biological control, but you also can use bacteria that, while harmless to humans, makes insect pests very sick and eventually very dead. The most common and useful biological controls are forms of *Bacillus thuringiensis,* or Bt, which kill the larvae of moths and butterflies (that is, caterpillars). Another variety of Bt, *B.t. tenebrionis* or *B.t. San Diego,* kills the larvae of Colorado potato beetles. *Bacillus popilliae* (milky spore disease) is an effective control of Japanese beetle grubs.

  Spinosad is a new biological control agent that has many uses. This soil-dwelling bacteria was discovered in Jamaica as a byproduct in the rum-making industry. It kills a broad range of insects, including caterpillars, thrips, spider mites, and leaf miners, but it isn't harmful to beneficial insects, animals, or pets. However, it is toxic to honey bees so spray it on cloudy days or late in the evening when the bees are less active. As with Bt, the insect must eat the toxin for it to work.
- **Botanical insecticides:** *Botanical insecticides* are derived from plants. The most useful insecticides against vegetable pests are *pyrethrins,* which are derived from the painted daisy, *Chrysanthemum cinerariifolium.* They're broad-spectrum insecticides, which means they kill a wide range of insects. Unfortunately, that means some of the good guys are killed, too. So to avoid killing bees, for example, spray pyrethrins late in the evening. Use this pesticide as a last resort. The advantage to using pyrethrins is that it kills pests such as aphids and beetles quickly, and has low toxicity to mammals. However, always follow the label and never apply more than is recommended.

WARNING

The terminology can be confusing. *Pyrethrum* is the ground-up flower of this type of daisy. *Pyrethrins* are the insecticide components of the flower. You also may see insecticides called *pyrethroids,* however. Pyrethroids, such as permethrin and resmethrin, are synthetic compounds that resemble pyrethrins but are more toxic and persistent. They shouldn't be used in organic gardens.

- **Home remedies:** Not all pesticides are exotic. Many gardeners have had great success using common household products to control insects in their gardens. One favorite home remedy is adding a clove or two of garlic and a few teaspoons of cayenne to a quart of water and then blending it all in a mixer. You then strain the solution to remove the chunks, and using a hand-held sprayer, spray your plants to control insects, such as aphids and whiteflies, and repel animals, such as rabbits and deer. Of course, after it rains, you have to reapply the mix. Commercial insecticide products, such as Hot Pepper Wax and Garlic Barrier, which are based on the common foods, also are available. Either type of product is effective, simple, safe, and fun to try.
- **Insecticidal soaps:** Derived from the salts of fatty acids, *insecticidal soaps* kill mostly soft-bodied pests such as aphids, spider mites, and whiteflies. They also can be effective against Japanese beetles. They work fast, break down quickly, and are nontoxic to humans. Insecticidal soaps are most effective when mixed with soft water because soaps can sometimes burn tender foliage.
- **Neem oil:** *Neem oil* is extracted from the seed of the tropical neem tree. It has been used for centuries in India as an insecticide, to kill parasites in cattle, and even as a toothpaste for humans. Needless to say, it's very safe (except to unlucky pests). Home gardeners can purchase neem oil to repel and kill insects including aphids, whiteflies, leaf miners, caterpillars, and many others.
- **Summer or horticultural oil:** When sprayed on a plant, this highly refined oil smothers insect pests and their eggs. The words "highly refined" mean that the sulfur and other components of the oil that damage the plant are removed. This oil is relatively nontoxic and short lived. Use it to control aphids, mites, thrips, and certain caterpillars.

WARNING

Make sure that you don't confuse summer oil with dormant oil. Dormant oil should be applied to leafless trees and shrubs during the winter. It isn't meant to be used on vegetables.

Double-check the oil's product label to make sure that you can use the oil on plants during the growing season. Then follow the mixing instructions carefully. Water your plants before and after applying the oil. But don't apply the oil if temperatures are likely to rise above 85 degrees Fahrenheit. When it's that hot, the oil can damage plant leaves.

ANSWERING FAQS ON IPM

A fancy buzzword term you'll hear a lot when talking about garden pests is IPM, or integrated pest management. Largely thought of as strictly an organic approach, *IPM* simply outlines logical steps for dealing with garden pests that don't include chemical warfare (pesticides). But IPM isn't just for organic gardeners; many tenets of IPM are just sound gardening strategies that have been covered elsewhere in this book and practiced long before organic was hip.

Putting the right plant in the right place is one IPM tip, because a weakened plant struggling in a bad location is more susceptible to pests. But other IPM techniques can include starting with pest-resistant plant varieties, scattering a crop throughout your homestead rather than in one huge patch, and encouraging beneficial animals such as spiders, birds, toads, bats, lizards, and "good" insects to take up residence near your garden. Often, these beneficial predators are purposely released into the garden to hunt to their hearts' content.

When pests are encountered, IPM first dictates determining whether control is even necessary. If the damage is merely cosmetic, limited to just a plant or two, or unique to a crop that will be harvested imminently, control measures may not be warranted. The pest may be allowed to stay. This process is called *establishing damage thresholds*. Control methods, when needed for unacceptable damage, often include tactics described earlier: physical barriers, handpicking, hosing off with plain water, or trapping. Least-toxic tactics first, more-toxic methods only if necessary, chemical pesticides are not part of the equation.

Integrated pest management may have a mysterious-sounding acronym, but homesteaders who use common sense and nontoxic methods to grow healthy vegetables are already practicing IPM.

REMEMBER

Always follow the instructions on the product label exactly; in fact, not following these instructions is against the law. Also, wear gloves when mixing and spraying pesticides, and spray when the wind is calm. Store the chemicals in properly labeled containers well out of the reach of children (a locked cabinet is best). Dispose of empty containers as described on the label, or contact your local waste disposal company for appropriate disposal sites.

Giving your plants some friends: companion planting

A *companion plant* is one that provides some sort of benefit to other plants growing nearby. It's sort of like how a good friend makes life easier for you. Well, plants have good friends, too. For example, the cover crops mentioned in Chapter 5 of this minibook can be considered companion plants.

Some plants are grown together because they seem to increase each other's yields. But other companion plants repel pests. Is that really possible? Well, no clear-cut evidence says companion planting works against pests. But some people swear by it. It is true, however, that a variety of plants, herbs, and flowers provides a diverse ecosystem so that predatory insects are more likely to hang around and take care of the bad guys. Besides, trying some of these combinations certainly won't hurt your garden.

These plants are thought to repel specific pests; plant them near crops where these pests are a common problem:

- **Anise** planted among members of the cabbage family (cabbage, broccoli, cauliflower, kale, and so on) is said to repel imported cabbage worms.
- **Basil** is said to repel whiteflies, aphids, and spider mites; it's a good companion to tomatoes because these are insects that feed on tomato plants.
- **Catnip** is said to repel some types of aphids, flea beetles, squash bugs, and cucumber beetles.
- **Garlic** may repel nematodes and other soil insects.
- **Leeks** are thought to repel carrot flies.
- **Marigolds** planted around vegetables are said to repel root nematodes, Mexican bean beetles, and Colorado potato beetles.
- **Mustard greens** are supposed to repel aphids.
- **Nasturtiums** are said to repel Colorado potato beetles.
- **Radishes** may repel striped cucumber beetles.
- **Ryegrass** may repel root-knot nematodes.
- **Southernwood** may repel moths and flea beetles.
- **Tansy** is supposed to repel some aphids, squash bugs, and Colorado potato beetles as well as ants.
- **White clover** may repel cabbage root flies.
- **Wormwood** may repel flea beetles.

Many herbs, such as rosemary, oregano, and coriander, also are said to repel pests. Smaller companion plants, such as marigolds, can be interplanted with vegetables. Taller or more vigorous plants, such as ryegrass or wormwood, should be planted nearby — but not among — vegetables. You don't want them to overwhelm your veggie plants.

The research on companion planting may be thin, but hey, give it a try to see if it works!

Rotating crops

WARNING

If you plant the same vegetables in the same spot year after year, you're going to cause a number of problems, including these:

- Insects and diseases that spend part of their life cycle in the soil will build up there and be more difficult to control.
- Specific nutrients that the vegetables need will consistently be depleted and will be harder to replace.

The way around these problems is to rotate your crops from season to season. In other words, plant them in different beds, as far away as possible from where they were planted before. Crop rotation is easy if you keep a journal and make note of what was planted where. And if you keep things out of the same beds for three years, you'll probably be in good shape.

REMEMBER

It's important to do more than rotate individual crops. You should rotate families of crops as well. A disease or insect that attacks one plant in a family is likely to attack others. Blight on tomatoes and potatoes is an example. When rotating crops, make sure you don't plant a family member in the same spot three years in a row. For example, in one bed, plant beans (legume family), the next year plant potatoes (tomato family), and the third year plant cucumbers (squash family). After that, you can start over with another legume-family vegetable or start another rotation series. Keep the families apart for three years, and you'll have fewer problems in the veggie patch. Table 6-1 shows a few possible rotation schedules.

TABLE 6-1 Crop Rotation Ideas

First-Year Crop	Second-Year Crop	Third-Year Crop
Peas	Corn	Cover crop (grasses, legumes, or grains)
Tomato	Radish	Cabbage
Green beans	Squash	Lettuce

The more crop families you have represented in your garden, the more involved the rotation schedule may become. (Here's an instance where keeping a garden journal or crop diary from year to year has saved many gardeners!) The following section offers a rundown of some of the most popular crops in each botanical family:

- **Amaranthaceae:** Members of the goosefoot family you may recognize are beets, spinach, and chard.
- **Apiaceae:** Crops in the umbel family include carrots, celery, parsnips, fennel, cilantro, dill, and parsley.
- **Asteraceae:** In the aster family you'll find lettuce, artichokes, radicchio, and endive. Other members include garden beauties such as sunflowers, cosmos, marigolds, chamomile, and Echinacea.
- **Brassicaceae:** The cool-season cole crop family includes broccoli, cauliflower, cabbage, kale, radishes, turnips, Brussels sprouts, and collard greens.
- **Curcurbitaceae:** The gourd family is made up of vining plants. Cucumbers, zucchini, squash, melons, and pumpkins are members of this family.
- **Fabaceae:** Peas, beans, and peanuts are part of this, the legume family. Be aware that some common cover crops such as clover and alfalfa are also legumes, so they need to be rotated as well.
- **Lamiaceae:** The mint family features popular herbs such as basil, rosemary, thyme, oregano, sage, lavender, and mints. Homesteaders growing these plants should rotate them just as they do vegetables.
- **Liliaceae:** Onions, garlic, shallots, leeks, and chives are members of the allium family. So is asparagus, but that must be left to grow in the same bed for several years; when it rotates, it must move to a bed that hasn't seen any of these other family members for several years.
- **Solanaceae:** The nightshade family includes tomatoes, peppers, eggplants, and potatoes other than sweet potatoes. (Sweet potatoes are in a separate family, along with morning glories.) Okra is sometimes included here, although it is, scientifically speaking, a member of the Malvaceae family, the same as cotton.

If you have only one sunny spot to garden, consider using containers as a way to rotate crops. For example, plant your tomatoes in a container one year and in the garden the next.

IN THIS CHAPTER

- **Harnessing heat in planting beds with fabric, plastic, and glass**
- **Taking plants indoors with greenhouses and alternative growing methods**

Chapter 7

Extending Your Season

In most parts of the country, the traditional growing season is straightforward. Prepare the soil in spring, sow in April or May, harvest in summer and fall. Mild winter areas such as Florida, Texas, and southern California have more planting in fall and winter and less in summer, with harvests year-round depending on the vegetable. However, by just planting once or twice a year, vegetable gardeners are missing out on opportunities to extend the harvest season and grow more in less space.

After you start vegetable gardening, you may get hooked on having fresh vegetables from your garden year-round. Unless you live in a mild climate, such as zone 9 or 10 (see Chapter 1 of this minibook for more on zones), the best way to get the most vegetables from your garden is to use season-extending devices and techniques. These methods protect your vegetables from deadly frosts in fall and enable you to get an earlier start in spring. Of course, selecting the right vegetables to grow also is vital to your success.

In general, greens, root crops, and cool-season cole crops are the best vegetables to grow in cold weather. However, you can extend the length of time that you harvest warm-season crops — such as melons, tomatoes, and peppers — by using the season-extending methods in this chapter. Whatever plants you grow, these techniques enable you to harvest fresh vegetables for most of the year.

Covering Your Rows

Floating row covers (see Figure 7-1) are among the best things ever to happen to veggie gardeners. The material, which is like cheesecloth, is lightweight and lets air, sunlight, and water pass through it. Also, when row covers are used on newly sown plants in the spring, they keep the air and soil a little warmer, thereby helping seeds germinate faster and young plants grow more quickly.

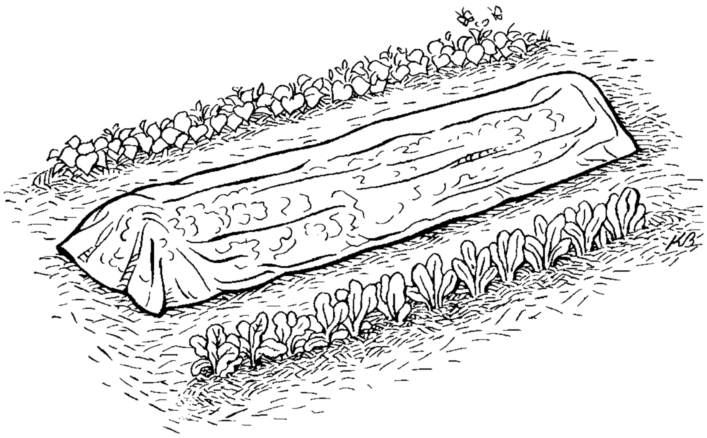


FIGURE 7-1: Floating row cover.

Illustration by Kathryn Born

Row cover is available in different thicknesses, depending on how you intend to use it. Some are meant merely to keep out insect pests, while others are for winter use. The delicate material may not seem like much, but it's thick enough to protect plants down into the mid-20 degrees F. Lay the floating row cover over young seedlings, loosely fastening it to the ground with boards or stones, and the plants will literally lift it up as they grow.

You may choose to use floating row covers on peppers, for example, in spring to ensure an early harvest of fruits, because pepper flowers need warm air temperatures. But then the row covers help at the other end of the season, too, by holding in heat and moderating the cool autumn-night temperatures. You can grow greens, root crops, and cole crops to maturity under a floating row cover.

Floating row covers can also keep plants relatively safe from insect pests — such as cabbageworms, cucumber beetles, and squash bugs. They also help keep critters such as rabbits away. But be sure to spread them over your plants early enough in the season. If you wait too long before covering your plants, the insects will have a chance to set up housekeeping in the garden, and they'll thrive under the protective covering.

Get covers in place when plants are young and make sure the edges are secured to the ground so pests can't slip under. And check periodically under the row cover for any insects that might have sneaked inside.

REMEMBER

For vegetables that require pollination by insects, such as pumpkins and squash, remove row covers as soon as you see the first flowers. For crops that don't need pollination by bees, such as lettuce and broccoli, you can leave the row cover on throughout the growing season — as long as it doesn't hold in too much heat. The row cover prevents cabbage moths, aphids, and other pests from getting to your vegetables.

Alternatively, you can use a clear plastic cover draped over half-circle wire or pipe hoops to create a tunnel effect (see Figure 7-2). Clear plastic heats up your crops faster and warmer than floating row cover material, but it needs venting to keep the plants from overheating.

REMEMBER

In parts of the country where snow load is a concern, sturdier pipe should be used to create the hoops for your row covers. Electrical conduit with lumber reinforcement boards running atop the arches for the length of the bed will help keep your tunnel from collapsing due to heavy snow. Home improvement centers sell conduit as well as the required bending tool. Many garden supply sources sell clips that make fastening your cover material to the metal conduit easy.

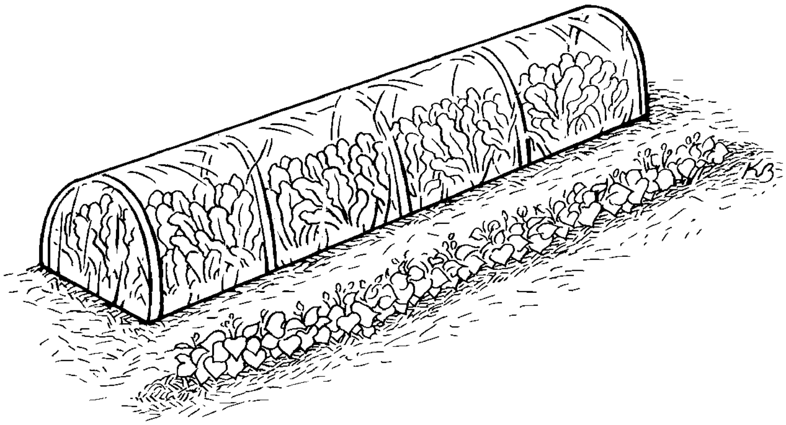


FIGURE 7-2: A clear plastic grow tunnel.

Using Cold Frames

A clever way to start your growing season earlier in the spring and keep it going long into the frosty fall is to make or buy a cold frame, as seen in Figure 7-3. *Cold frames* are bottomless, insulated boxes made of wood, hay bales, metal, or plastic; they work like miniature greenhouses. The lid of the box is angled slightly to increase its exposure to the sun; its plastic or glass top keeps the inside much warmer than the outside air temperature.

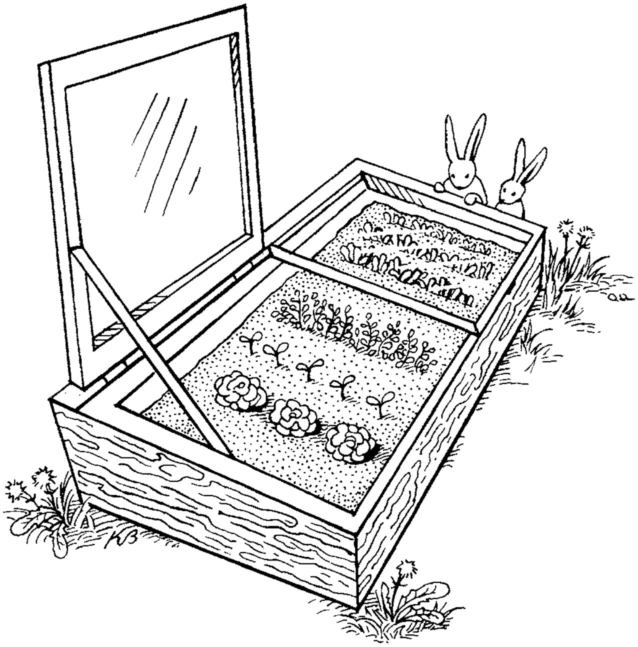


FIGURE 7-3: Cold frames are a good way to extend the growing season in spring and fall.

Illustration by Kathryn Born

Even in the coldest climates, you can use a cold frame to harvest food year-round. Some professional gardeners as far north as zone 5, where winter temperatures can dip down to −20 degrees Fahrenheit, can harvest vegetables every month of the year by planting cold-weather-tolerant crops in cold frames.

In the spring, grow a crop of lettuce in a cold frame, and get your other warm-season crops off to an early start. In the fall and winter, try cold-tolerant spinach, kale, and leeks.

You can make your cold frame large enough to fit over a raised bed in the garden, or keep it small and portable to move around as needed. Cold frames are also handy for hardening off seedlings before transplanting them to the garden.

REMEMBER

Although the purpose of a cold frame is to trap heat, on sunny days, even in winter, a cold frame can get so hot that it burns the tender plants inside. Even on very cool but sunny spring or autumn days, the interior of the box really heats up, much like a car with its windows rolled up. The key to using cold frames is ventilating them as needed. Check your cold frame once a day on sunny days, opening or venting the top slightly to allow hot air to escape. Automatic vent openers, available from greenhouse suppliers, raise and lower the top automatically without electricity, depending on the air temperature.

You can purchase a premade cold frame for $100 to $200, or you can create your own, using materials you may already have lying around. Refer to Chapter 5, Book 1 for the steps to this easy building project that pays big dividends on the homestead.

Going with Greenhouses

Having a greenhouse is a great way to extend the growing season, which is really important in areas where winters are long and summers are short. You can grow plants inside the controlled atmosphere of the greenhouse during times when there's no way they'd grow outside. You can also start seeds in a greenhouse so the plants are already hardy when it's time to put them outside. (You'll find more on starting seeds indoors in Chapter 4 of this miniboook.)

Traditionally, the greenhouse is a separate building (as seen in Figure 7-4), with walls of glass or plastic that let the sun come in and nourish the growing plants, but you can choose from many designs. You can even build a lean-to on the south side of your house or use an entire floor or room in the house as long as it gets good southern exposure.

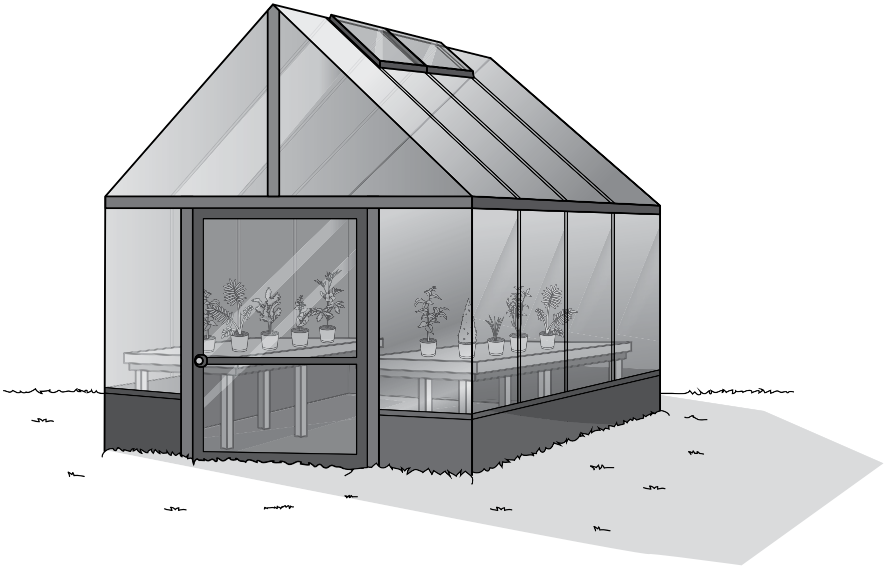


FIGURE 7-4: A typical glass greenhouse.

CATCHING SOME RAYS (AND PUTTING THEM TO WORK)

On any given day, 35,000 times the total amount of energy that humans use falls onto the face of the Earth from the sun. If people could just tap into a tiny fraction of what the sun is providing each day, society would be set. Backyard homesteaders, in particular, are keen on harnessing some of the sun's awesome (and free) power to be more self-sufficient in a variety of ways that go beyond greenhouse growing.

Solar-powered landscape lighting can make your garden easier to navigate. A solar fountain is an easy add-on to a pond. Rig up a solar portable shower (like backpackers and campers use) to get a quick and warm rinse-off after a dirty day gardening. Use basic photovoltaic (PV) cells to power electric fences, run lights in your chicken coop, or keep your flock's watering dish from freezing.

Some homesteaders keep stepping up their solar efforts to include an array of panels on the roof of their home to go off the grid and manufacture their own electricity! And to toast all of your new solar-powered energy-producing efforts, you can always make yourself a big batch of sun tea.

Greenhouse gardening can be involved — it's container gardening and vegetable growing at their highest levels in an enclosed, heated, controlled-atmosphere room. You need to pay attention to many more conditions in a greenhouse, such as temperatures that are too hot and too cool, fertility, pests (once they get started, they're tough to stop in a greenhouse), pollination for crops such as cucumbers and melons, and so on. You have to be dedicated; the easiest time to grow good crops in a greenhouse is in the spring and fall to extend the season. Winter and summer are generally the toughest times to grow plants in a greenhouse because of the extremes in temperature and available light.

Gather the materials yourself or go for a kit with everything already cut and sized and ready to put together. Here are some basic components of a greenhouse:

- **Frame:** Materials for the frames vary widely. You can go with a wood frame, a hoop design using PVC or metal conduit, fiberglass, or molded plastic.
- **Walls:** The walls can be glass, plastic, or polycarbonate panels (see-through rigid plastic). Glass is expensive, so plastic can be a good alternative. Try a double layer of plastic film to add an insulation buffer. Glass is a poor

insulator, so unless you want to heat the greenhouse during a cold winter, you typically use a glass greenhouse only in warmer months.

- **Heat source:** You can go with the simple form — just letting the sun do its thing during the day — or you can install solar-powered heating. Another heating option is to put a large compost heap inside the greenhouse. Compost generates heat as it decomposes, which can heat the interior.
- **Floor:** A greenhouse floor needs to be able to withstand water leaks and mud spillage. A gravel floor provides hassle-free drainage, but its dark, rough surface also acts as an *absorber* that captures the energy of the sunlight penetrating the space and transforms it into heat.
- **Water system:** Whether you simply use a hose or set up an automatic sprinkling system, you need some way to get water to the plants.
- **Ventilation:** You have to keep the temperature inside within the optimal growing range, not only in cooler seasons. Temperatures in a hot summer area can go over 120 degrees inside. To be sure the heat doesn't kill the plants, you need to ventilate. The air should contain enough moisture to grow plants but not so much that rot and mildew form.

TIP

For the busy homesteader, an automatic vent opener — a compact, mechanical, heat-activated device — can open windows, skylights, greenhouse vents, and so on at a temperature you select. Because they don't use electricity, you can mount them anywhere. For heavy windows and vents, simply use multiple units.

Well-designed greenhouses in cold climates can support the growth of plants all winter long, even in freezing conditions. In fact, greenhouses often need cooling means such as vents or radiant barriers to keep from getting too hot. On the other hand, greenhouses need to be sealed in order to maximize warming in the winter, so the interior air can get stagnant or too humid for comfort. The bottom line is that greenhouses need constant management and manipulation of air movement and sun exposure, not to mention the work needed to grow healthy, vigorous plants. Greenhouses are also prone to getting very dirty, so they're more commonly separated from the house.

TIP

You don't even have to have a glass structure for a greenhouse. You can use plastic hoop houses instead. They're easy to build, inexpensive, and a great way to get into this method of gardening. Like supersized versions of the grow tunnel described earlier in this chapter, walk-through hoop houses (see Figure 7-5) have become popular because of their low cost and ease of use. They have a metal semicircular shell with clear plastic pulled over it and a door on one end (or even at both ends).

They keep the air warmer than a cold frame, but they're not as warm as a conventional greenhouse. Plus, they're relatively inexpensive, starting at under $200. You can add options such as automatic vents, roll-up sides, automatic watering systems, blinds and reflectors, and so on.

For instructions on building your own walk-through hoop house, flip ahead to Book 5, Chapter 1, where you'll find a step-by-step guide.

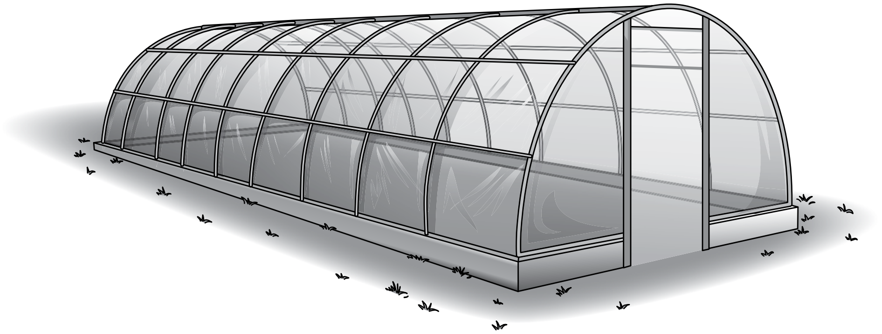


FIGURE 7-5: A hoop house is an inexpensive alternative to a greenhouse.

Getting Your Feet Wet with Hydroponics, Aquaponics, and Aeroponics

Some gardening techniques allow the homesteader to not only maximize their conventional growing space but also extend the season by creatively moving some crops to spots where the growing conditions can be carefully controlled. These methods may seem space-age (and are in some cases) because they don't use traditional garden beds — or even dirt!

Urban gardeners have popularized them because of their small space requirements, but many homesteaders may also find value in adding hydroponics, aquaponics, and aeroponics to their repertoire.

Hydroponics

Hydroponics, in its simplest form, is growing plants without soil. All the necessary nutrients that would come from the plants' water supply is instead supplied by a nutrient solution rather than through the soil. Growing plants hydroponically helps gardeners and farmers grow more food more rapidly in smaller areas (greenhouses, living rooms, classrooms, and rooftops, for instance) and to produce food in parts of the world where space, good soil, and/or water are limited.

You may have bought hydroponic tomatoes at the grocery store, or you may have seen the amazing hydroponic lettuce at Disney World. But even for the homesteader, it's possible to grow crops (usually in very small quantities) indoors hydroponically when conditions outside aren't conducive or ideal.

For the plants to grow successfully, the nutrient solution must contain several elements, including nitrogen, potassium, phosphorus, iron, manganese, and sulfur.

Hydroponics is an emerging niche of gardening, with entire retail stores dedicated to it. You do need special equipment and growing techniques, but you can grow any plant this way.

Aquaponics

In *aquaponics*, the nutrient solution is water containing fish excrement. Aquaponics is the integration of hydroponics and aquaculture (the cultivation of the natural produce — such as fish or shellfish — of water). Live fish are raised in a traditional fish tank. The fish excrete their waste into the surrounding water, which is used to supply nutrients to the growing plants positioned above the tank. Bacteria living in the water and on the growth medium eat the fish wastes and unlock nutrients for the plants. The plants absorb the nutrients, and the filtered water is returned to the fish tank. (For more on which kinds of fish may work best for your homestead, go to Book 4, Chapter 5.)

Aeroponics

Aeroponics refers to growing plants in an environment of mostly air. There's no soil, and the water that feeds the plants comes in the form of a mist, usually released automatically at regular intervals. A tower-oriented garden planting system (as shown in Figure 7-6) is one example of a state-of-the-art vertical aeroponic growing system.

Because of its unique technology and vertical design, the Tower Garden uses less than 10 percent of the water and land required by traditional, soil-based agriculture. The Tower is easy to assemble and maintain, and it can be placed in any relatively sunny place outside (or inside if you use grow lights). There's no soil, no weeds, and no ground pests to worry about with these systems. For more on this product, visit `www.towergarden.com`.

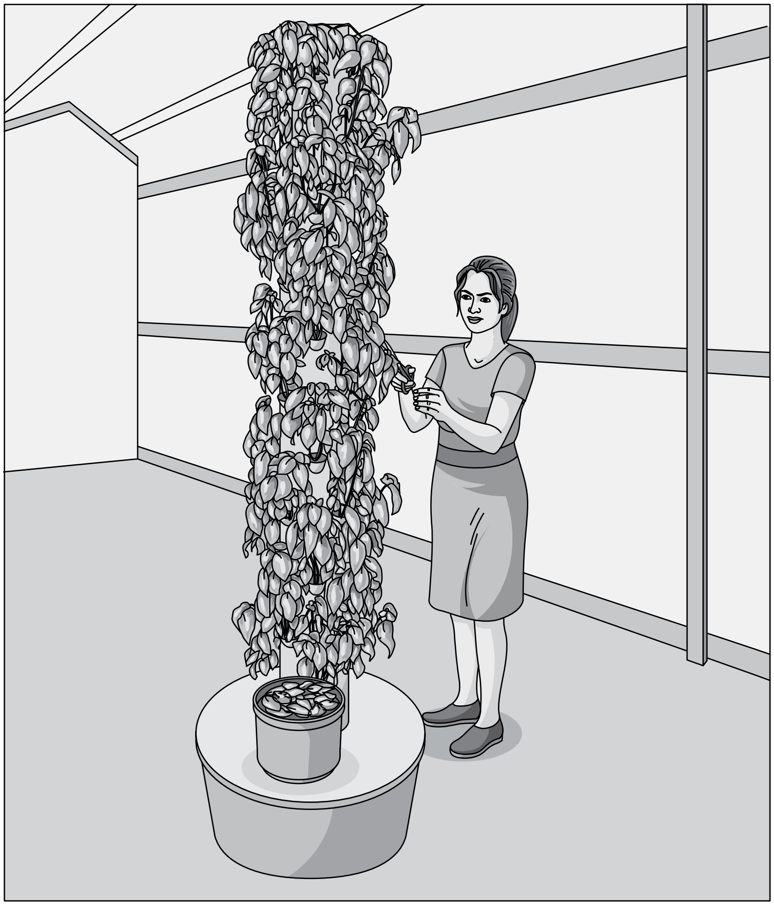


FIGURE 7-6: A vertical aeroponics system.

2

Preserving the Harvest

Contents at a Glance

CHAPTER 1: **Canning Basics** 183
Starting Successful Canning 183
Gathering Your Canning Gear 185
Putting Safety First 191

CHAPTER 2: **Water-Bath Canning** 197
Water-Bath Canning in a Nutshell 197
Gearing Up for Water-Bath Canning 198
Water-Bath Canning Step-by-Step 200
Adjusting Your Processing Times at High Altitudes 206
Canning Fresh Fruit (Yes, That Includes Tomatoes) 207
Fresh Fruit Canning Recipes 211
Jam, Chutney, Relish, and Salsa Recipes 223

CHAPTER 3: **Pressure Canning** 231
Understanding the Fuss about Low-Acid Foods 232
Choosing a Pressure Canner 232
Pressure Canning Step-by-Step 238
Pressure Canning at Higher Altitudes 242
Canning Vegetables 243
Vegetable Canning Recipes 246

CHAPTER 4: **Pickling** 269
Perusing Pickling Ingredients 269
Brining Education 272
Adding Crunch to Your Food 274
Pickling Equipment and Utensils 275
Pickled Vegetable Recipes 275

CHAPTER 5: **Freezing** 291
Focusing on Freezing 291
Giving Fruit the Freeze 295
Frozen Fruit Recipes 298
Blanching Perfect Vegetables 303
Frozen Vegetable Recipes 304
Freezing Fresh Herbs 316

CHAPTER 6: **Drying** 319
Opening the Door to Successful Food Drying 319
Choosing a Drying Method 320
Protecting the Life of Your Dried Food 324
Snacking on the Run: Drying Fruit 325
Dried Fruit Recipes 328
Drying Vegetables for Snacks and Storage 338
Dried Vegetable Recipes 340
DIYing the Drying of Herbs 350

CHAPTER 7: **Root Cellaring and Storage** 357
Finding the Perfect Place for Cold Storage 357
Following Simple Storage Rules 362
Preparing Foods for Cold Storage 364

IN THIS CHAPTER

- **Getting comfortable with canning food for later use**
- **Making canning easier with the right equipment**
- **Adopting best practices for safe canning**

Chapter 1

Canning Basics

Over the years, thanks to busy lifestyles and the convenience of refrigeration and supermarkets, the art of canning food has declined. Other than jams and jellies, many people started thinking of canning as sort of a novelty hobby. But today, many people have a renewed interest in learning this art; they are finding that canning and preserving foods is an inexpensive and easy way to have a full pantry. For the backyard homesteader, canning is an essential skill and the very best way to make the most of what comes out of the garden.

If you're new to canning, don't be overwhelmed or scared off by the rules. This chapter walks you through easy, step-by-step instructions for the two most popular techniques, the only two approved by the United States Department of Agriculture (USDA). After you understand the basic procedures for each method, it's just a matter of concentrating on preparing your recipe.

Starting Successful Canning

Canning is the most popular preserving method used today. Don't let anyone tell you that home-canning is complicated and unsafe. It's simply not true. *Canning* is the process of applying heat to food that's sealed in a jar in order to destroy any microorganisms that can cause food spoilage. All foods contain these microorganisms. Proper canning techniques stop this spoilage by heating the food for a specific period of time and killing these unwanted microorganisms. Also, during the canning process, air is driven from the jar and a vacuum is formed as the jar cools and seals. This prevents microorganisms from entering and re-contaminating the food.

Becoming a successful canner takes time, effort, and knowledge of the rules. Follow these tips for achieving great results:

- **Start with the freshest, best products available.** Preserving doesn't improve food quality. If you put garbage in, you get garbage out.
- **Know the rules and techniques for your canning or preserving method before you start your work.** Don't try to learn a technique after you've started your processing.
- **Work in short sessions to prevent fatigue and potential mistakes.** Process no more than two items in one day, and work with only one canning method at a time.
- **Stay up to date on new or revised guidelines for your preserving method.** Beyond what you read in this chapter, you can also go to websites such as `www.freshpreserving.com`, created by the makers of Ball canning supplies. Here you can find tips and directions for canning just about anything.
- **Use the correct processing method and processing time to destroy microorganisms.** The recipe will tell you what method to use, but it helps if you understand the difference between high- and low-acid foods and how the canning methods for each differ.
- **Know the elevation you're working at.** Adjust your processing time or pressure when you're at an altitude over 1,000 feet above sea level.
- **Put together a plan before you start your preserving session.** Read your recipe (more than once). Have the proper equipment and correct ingredients on hand to prevent last-minute shortages and inconvenient breaks (make a list of what you need and check off items as you gather them).
- **Test your equipment.** If you're using a pressure canner or an electric dehydrator, test out the equipment to ensure everything's working properly. And always check the seals on your jars.

REMEMBER

- **Use recipes from reliable sources or ones that you've made successfully before.** Follow your recipe to the letter. Don't substitute ingredients, adjust quantities, or make up your own food combinations. Improvisation and safe food preservation aren't compatible. This also means you can't double your recipe. If you require more than what the recipe yields, make another batch. Always use the size jars that are recommended in the recipe as well. Trying to use a larger or smaller jar may throw off the yield and final result.

Gathering Your Canning Gear

The tools that make canning and preserving easier are many of the very same tools that are in most well-stocked kitchens. When a recipe recommends a tool for canning, there's a practical reason for doing so. Using the proper tool for the job decreases the chance of a jar failing to seal or being able to harbor bacteria. It can also reduce the chance of mishaps and injuries.

But the equipment in this section is especially designed for canning, which means you'll use it during canning season but not much otherwise. Make sure you store these items in a safe, clean location. And be sure to look over every piece each time you use it to check for wear and tear.

Canning vessels

The kind of food you'll be canning determines the type of vessel you'll be using: a water-bath canner or a pressure canner.

Water-bath canner

A *water-bath canner,* also referred to as a *boiling-water canner,* is a kettle used for processing high-acid foods (primarily fruits, jams, jellies, condiments, and pickled foods). The canner consists of a large enamelware or stainless-steel pot with a tight-fitting lid and a jar rack. You'll learn how to use this piece of gear in Chapter 2 of this minibook.

Pressure canner

A *pressure canner,* sometimes referred to as a *steam-pressure canner,* is used for canning low-acid foods (primarily vegetables, meats, fish, and poultry) in an airtight container at a specific pressure. A weighted gauge or a dial gauge measures steam pressure in the canner. This ensures that the high temperature of 240 degrees is attained to safely process your food. Dive deeper into pressure canning in Chapter 3 of this minibook.

Canning tools

The tools in this section are must-haves for water-bath or pressure canning. Safety in the kitchen is number one, and the right tools for handling hot, filled jars and other large canning equipment are indispensable.

Jar lifter

A *jar lifter* is one tool you don't want to be without. It's the best tool available for transferring hot canning jars into and out of your canning kettle or pressure canner. This odd-looking, rubberized, tonglike item (check out Figure 1-1) grabs the jar around the *neck* (the area just below the threaded portion at the top of the jar) without disturbing the screw band.

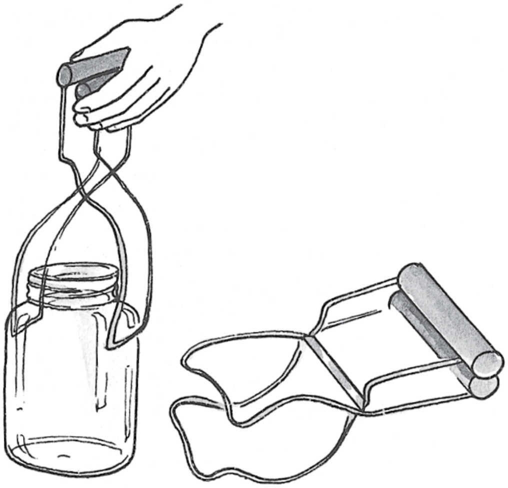


FIGURE 1-1: Jar lifters.

Foam skimmer

A *foam skimmer,* shown in Figure 1-2, makes removing foam from the top of hot jelly, jam, or marmalade easy while leaving any pieces of fruit or rind in the hot liquid. (The openings in slotted spoons are too large to achieve quick and efficient foam removal.)

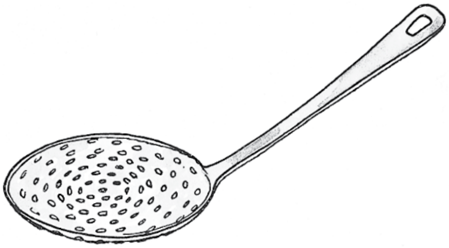


FIGURE 1-2: A foam skimmer.

Home-canning jars

Over the years, many types of jars with many varieties of seals have been used for home-canning. The most commonly used jars bear the names of Ball and Kerr and are commonly referred to as Mason jars. They use a two-piece cap to produce a vacuum seal in the jar after heat processing.

REMEMBER

To ensure safe home-canning today, use only jars approved for home-canning and made from tempered glass. *Tempering* is a treatment process for glass that allows the jars to withstand the high heat (212 degrees) of a water-bath canner, as well as the high temperature (240 degrees) of a pressure canner, without breaking.

Home-canning jars come in many sizes: 4-ounce, half-pint, 12-ounce, 1-pint, and 1-quart (see Figure 1-3). They offer two widths of openings: regular-mouth (about 2½ inches in diameter) and wide-mouth (about 3⅛ inches in diameter). Regular-mouth jars are used more frequently for jelly, jam, relish, or any other cooked food. Wide-mouth jars are mainly used for canning vegetables and pickles and meats, because it's easier to get the large pieces into the wide opening.

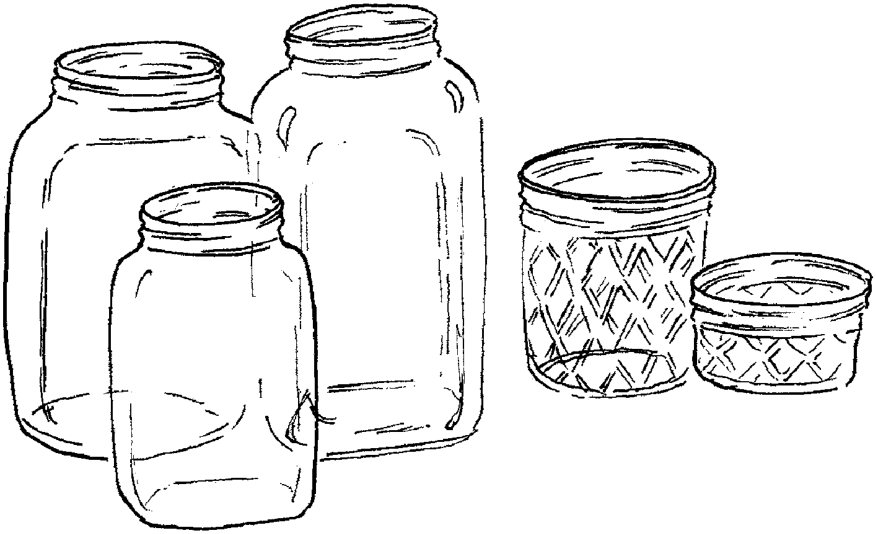


FIGURE 1-3: Varieties of canning jars: wide-mouth, regular-mouth, and jelly jars.

Two-piece caps

Two-piece caps consist of a lid and a metal screw band (see Figure 1-4). They're made specifically for use with modern-day home-canning jars.

- **Lids:** The underside edge of the lid has a rubberlike sealing compound that softens when it's heated. This compound adheres to a clean jar rim and creates an airtight seal after the heat-processing period. Traditional lids aren't reusable, but some modern styles are. Check out the Tattler brand at `https://reusablecanninglids.com/`

- **Screw bands:** The screw band holds the lid in place during the processing period and secures it in place when storing an opened jar in the refrigerator. After verifying that your cooled jars have successfully sealed, you remove the screw band before you store the canned food. The screw bands may be used many times as long as there are no signs of corrosion or rust and they aren't bent or dented.

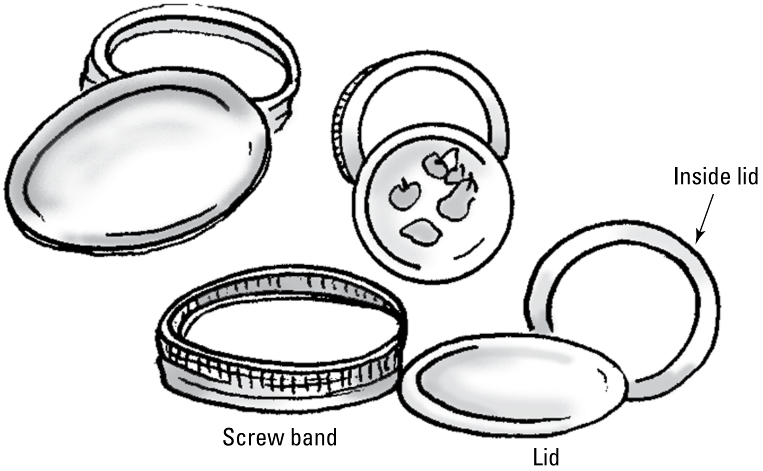


FIGURE 1-4: Two-piece caps: lids and screw bands.

MASON JARS

If the most commonly used glass home-canning jars bear the names of Ball and Kerr, why do we call them Mason jars? The Mason jar is named for its creator, James Landis Mason. He designed and patented a unique glass jar that uses a screw-top lid to create an airtight seal for food. This easy-to-seal jar replaced the large stoneware vessels that had previously been used for food storage.

The tapered jars we use today were introduced after World War II. They use a two-piece cap consisting of a lid and a metal screw band that fits the threaded jar top. Today, all home-canning jars are generically referred to as Mason jars. Thank you, Mr. Mason, for making the task of home-canning easy with the use of screw-top closures.

Lid wand

A *lid wand* (see Figure 1-5) has a magnet on one end of a heat-resistant stick. With it, you can take a lid from hot water and place it on the filled-jar rim without touching the lid or disturbing the sealing compound.

TIP

Place your lids top to top and underside to underside to prevent them from sticking together in your pan of hot water. If they do stick together, dip them into a bowl of cold water to release the suction. Reheat them in the hot water for a few seconds before using them. Also offset the lids as you place them in the water. This keeps them fanned out and easier to pick up singly.

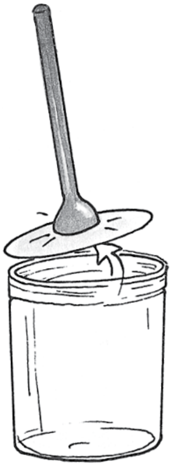


FIGURE 1-5: A lid wand.

Thin plastic spatula

A thin, flexible plastic spatula is the right tool for releasing air bubbles between pieces of food in your filled jars (check out Figure 1-6). Buy a package of chopsticks for an inexpensive alternative.

FIGURE 1-6: A thin plastic spatula for releasing air bubbles.

WARNING

Don't use a metal item or a larger object for this job because it may damage your food and crack or break your hot jar.

Wide-mouth canning funnel

A *wide-mouth funnel* (see Figure 1-7) fits into the inside edge of a regular-mouth or a wide-mouth canning jar and lets you quickly and neatly fill your jars. This is an essential tool for canning.

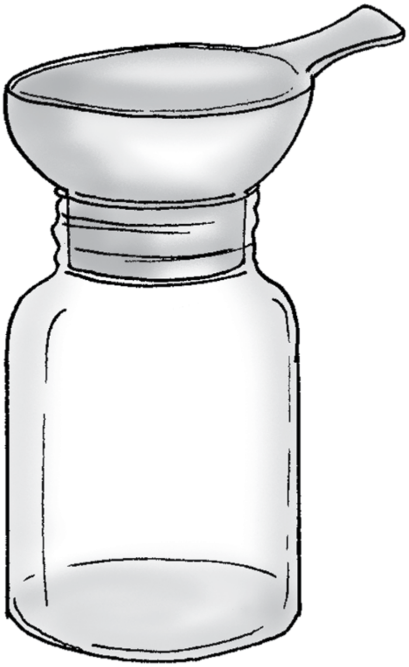


FIGURE 1-7: A wide-mouth canning funnel.

Jelly bag or strainer

A *jelly bag* is made for extracting juice from cooked fruit for making jelly. These bags aren't expensive, but if you'd rather not purchase one, make your own using a metal strainer lined with cheesecloth. Use a strainer that hangs on the edge of your pot or mixing bowl and doesn't touch the liquid. Go to the end of this chapter for instructions on making jelly.

Stoneware crocks

Stoneware crocks are available in sizes from 1 gallon to 5 gallons, usually without lids. They're nonreactive and are used for making pickles and olives. Make sure you use only crocks that are glazed on the interior and certified free of lead and *cadmium*, a form of zinc ore used in pigments or dyes.

WARNING

Be wary of using secondhand stoneware crocks. These crocks were often made with leaded glaze that will leach into your foodstuff. Because you do not often know the history of used items, this is an item that is best purchased new and not secondhand.

Putting Safety First

Preventing food spoilage is the key to safe canning. Over the years, home-canning has become safer and better. Scientists have standardized processing methods, and home-canners know more about using these methods. When you follow up-to-date guidelines exactly, you'll experience little concern about the quality and safety of your home-canned and -preserved foods. Here are a few things to keep in mind as you begin your canning career.

Packing your jars with care

How you fill the canning jars is important:

- **Don't overpack foods.** Trying to cram too much food into a jar may result in under-processing because the heat can't evenly penetrate the food.
- **Make sure your jars have the proper headspace.** *Headspace* is the air space between the inside of the lid and the top of your food or liquid in your jar or container (see Figure 1-8). Proper headspace is important to the safety of your preserved food because of the expansion that occurs as your jars are processed or your food freezes.
- **Make sure you release the air bubbles from the jar before sealing the lid.** No matter how carefully you pack and fill your jars, you'll always have some hidden bubbles.

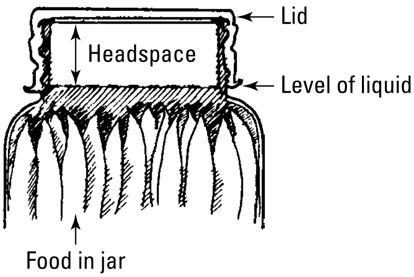


FIGURE 1-8: Headspace.

The all-important headspace

When you're canning food, too little headspace in your canning jars restricts your food from expanding as it boils. Inadequate space for the expanding food may force some of it out of the jar and under the lid, leaving particles of food between the seal and the jar rim. If this occurs, your jar won't produce a vacuum seal.

Leaving too much headspace may cause discoloration in the top portion of your food. Excess headspace can keep your jar from producing a vacuum seal if the processing time isn't long enough to exhaust the excess air in the jar.

Always use the headspace stated in your recipe. If your recipe doesn't give you a headspace allowance, use these guidelines:

- For juice, jam, jelly, pickles, relish, chutney, sauces, and condiments, leave headspace of ¼ inch.
- For high-acid foods (fruits and tomatoes), leave headspace of ½ inch.
- For low-acid foods (vegetables, meats, fish, and poultry), leave headspace of 1 inch.

REMEMBER

Headspace is also important when you're freezing food because frozen food expands during the freezing process. If you fail to leave the proper headspace in your freezer container, the lid may be forced off the container, or the container may crack or break. When your frozen food comes in direct contact with the air in your freezer, the quality of your food deteriorates and the food develops freezer burn (go to Chapter 5 of this minibook for more on freezing food). On the other hand, too much air space allows excess air in your container. Even though your food doesn't come in direct contact with the air in the freezer, the excess space in the top of the container develops ice crystals. When your food thaws, the excess liquid reduces the food's quality.

TIP

If you don't trust yourself to eyeball the headspace, use a small plastic ruler (about 6 inches long) to measure the correct headspace in the jar.

Releasing air bubbles from your jars

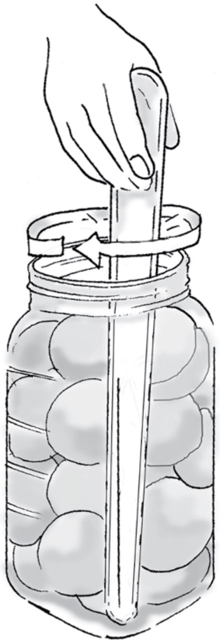
The most important thing to do when you're filling your jars is to release trapped air bubbles between the food pieces. This may seem unimportant, but air bubbles can play havoc with your final product:

- **Jar seals:** Too much air in the jar from trapped air bubbles produces excessive pressure in the jar during processing. The pressure in the jar is greater than the pressure outside the jar during cooling. This imbalance interferes with the sealing process.

- **Liquid levels:** Air bubbles take up space. When there's trapped air between your food pieces before sealing the jars, the liquid level in the jar drops when the food is heated. (For releasing air bubbles, see Figure 1-9.) In addition, floating and discolored food results from packing your food without the proper amount of liquid in the jars. Snuggly packed food eliminates air and allows enough liquid to completely cover the food with proper headspace (refer to Figure 1-8).

REMEMBER

Never skip the step of releasing air bubbles.



Use a nonmetallic spatula to press back gently on the contents. Go all the way around the jar.

FIGURE 1-9: Releasing air bubbles from your filled jars.

Knowing the acidity level of your food

Knowing the acidity level of the food you're processing is important because the *pH*, the measure of acidity, determines which canning method you use: water-bath or pressure canning. For canning purposes, food is divided into two categories based on the amount of acid the food registers:

- **High-acid** foods include fruits and pickled foods. Foods in this group have a pH of 4.6 or lower. Processing them in a water-bath canner destroys harmful microorganisms.

Tomatoes are considered a low-high acid food. With all of the new varieties of tomatoes, it is now recommended that the home canner add an acid to the canning process, to ensure that the proper acidity is reached every time.

- **Low-acid** foods, primarily vegetables, meat, poultry, and fish, contain little natural acid. Their pH level is higher than 4.6. Process these foods in a pressure canner, which superheats your food and destroys the more heat-resistant bacteria, such as botulism.

TIP

If you want to feel as though you're back in science class all over again, you can buy litmus paper at teacher- or scientific-supply stores and test the acidity level of your food yourself. Also referred to as pH paper, litmus paper is an acid-sensitive paper that measures the acid in food. When you insert a strip of pH paper into your prepared food, the paper changes color. You then compare the wet strip to the pH chart of colors that accompanies the litmus paper.

Adjusting your altitude

Properly processing your home-canned foods destroys microorganisms. Knowing your altitude is important because the boiling point of water and pressure in a pressure canner changes at altitudes over 1,000 feet above sea level. This occurs because the air is thinner at higher elevations. With less air resistance, water boils at a temperature below 212 degrees.

To produce food free from microorganisms at higher elevations, adjust your processing time and pressure to compensate for your altitude. Use the altitude adjustment charts in the sections for water-bath canning and pressure canning. These adjustments ensure that your food is heated to the correct temperature for destroying microorganisms.

Detecting spoiled foods

No one can't promise you that your home-canned foods will always be free from spoilage, but you can rest assured that your chances for spoiled food are greatly reduced when you follow the precise guidelines for each preserving method. If you suspect, for any reason, that your food is spoiled or just isn't right, don't taste it. Also, just because your food doesn't look spoiled, doesn't mean that it's not.

The best way to detect food spoilage is by visually examining your jars. Review the following checklist. If you can answer "true" for each of the following statements, your food should be safe for eating:

- The food in the jar is covered with liquid, is fully packed, and has maintained the proper headspace.
- The food in the jar is free from moving air bubbles.
- The jars have good, tight seals.
- The food has maintained a uniform color.
- The food isn't broken or mushy.
- The liquid in the jar is clear, not cloudy, and free of sediment.

After your food has passed the previous checklist, examine your jars more closely. If you discover any spoilage during any step of this process, don't continue your search, but properly dispose of your product.

1. **Hold the jar at eye level.**
2. **Turn and rotate the jar, looking for any seepage or oozing from under the lid that indicates a broken seal.**
3. **Examine the food surface for any streaks of dried food originating at the top of the jar.**
4. **Check the contents for any rising air bubbles or unnatural color.**

   The food and liquid should be clear, not cloudy.
5. **Open the jar.**

   There shouldn't be any spurting liquid.
6. **Smell the contents of the jar.**

   Take note of any unnatural or unusual odors.
7. **Look for any cottonlike growth, usually white, blue, black, or green, on the top of your food surface or on the underside of the lid.**

As mentioned, there are two different methods for canning food, with equipment specific to each. The method you use will depend on the type of food you're preserving. See Chapters 2 and 3 of this minibook to learn the ins and outs of water-bath canning and pressure canning, respectively.

IN THIS CHAPTER

- **Determining which foods are best for water-bath canning**
- **Canning fruits, making jams, and creating canned condiments**

Chapter 2

Water-Bath Canning

With water-bath canning, you essentially use a special kettle to boil filled jars for a certain amount of time. Common foods for water-bath canning include fruits and tomatoes, as well as jams, jellies, marmalades, chutneys, relishes, pickled vegetables, and other condiments.

You're probably wondering whether water-bath canning is safe for canning food at home. Rest assured: The answer is a most definite "Yes!" — provided that you follow the instructions and guidelines for safe canning.

In this chapter, you discover which foods are safely processed in a water-bath canner and get step-by-step instructions for completing the canning process. In no time, you'll be turning out sparkling jars full of homemade delicacies to dazzle and satisfy your family and friends. A sampling of recipes in included as well to get you started on your water-bath canning adventures.

Water-Bath Canning in a Nutshell

Water-bath canning, sometimes referred to as the *boiling-water method,* is the simplest and easiest method for preserving high-acid food. That means most fruit, as well as tomatoes, pickled vegetables, condiments, and sauces.

To water-bath can, you place your prepared jars in a *water-bath canner* (a kettle especially designed for this canning), bring the water to a boil, and then maintain that boil for a certain number of minutes as determined by the type of food and the size of the jar. Keeping the water boiling in your jar-filled kettle throughout the processing period maintains a water temperature of 212 degrees. This constant temperature is critical for destroying mold, yeast, enzymes, and bacteria that occur in high-acid foods.

WARNING

Water-bath canning and pressure-canning methods aren't interchangeable because the temperature of a water bath reaches only 212 degrees while the temperature of a pressure canner reaches 240 degrees, the temperature necessary to safely process low-acid foods. For more on pressure canning, go to Chapter 3 of this minibook.

Gearing Up for Water-Bath Canning

Just as you wouldn't alter the ingredients in a recipe or skip a step in the canning process, you don't want to use the wrong equipment when you're home-canning. This equipment allows you to handle and process your filled jars safely.

Water-bath canning kettles cost anywhere from $25 to $45. In some instances, you may purchase a "starter kit" that includes the canning kettle, the jar rack, a jar lifter, a wide-mouth funnel, and jars for about $50 to $60.

Following is a list of the equipment you must have on hand, no exceptions or substitutions, for safe and successful water-bath canning:

- **A water-bath canner:** The water-bath canner consists of a large kettle, usually made of porcelain-coated steel or aluminum, that holds a maximum of 21 to 22 quarts of water, has a fitted lid, and uses a rack (see the next item) to hold the jars (see Figure 2-1). Do not substitute a large stock pot for a water-bath canner. It is important for the jars to be sitting off the bottom of the canner, and racks that fit this purpose are included in your canner kit.

  TECHNICAL STUFF

  Although aluminum is a *reactive metal* (a metal that transfers flavor to food coming in direct contact with it), it's permitted for a water-bath canner because your sealed jar protects the food from directly touching the aluminum.
- **A jar rack:** The jar rack for a water-bath canner is usually made of stainless steel and rests on the bottom of your canning kettle. It keeps your jars from touching the bottom of the kettle, or each other, while holding the filled jars upright during the water-bath processing period. The rack has lifting handles for hanging it on the inside edge of your canning kettle (refer to Figure 2-1), allowing you to safely transfer your filled jars into and out of your kettle.

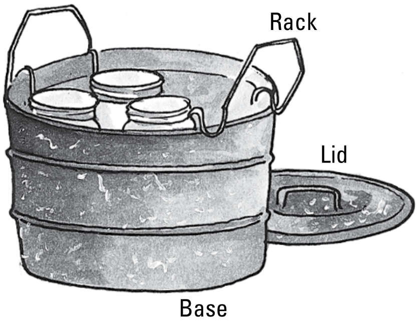


FIGURE 2-1: A water-bath canning kettle with the rack hanging on the edge of the kettle.

- **Canning jars:** Canning jars are the only jars recommended for home-canning. Use the jar size recommended in your recipe. For more on canning jars, refer to Chapter 1 of this minibook.
- **Two-piece caps (lids and screw bands):** These lids and screw bands, explained in Chapter 1 of this minibook, create a vacuum seal after the water-bath processing period, preserving the contents of the jar for use at a later time. This seal protects your food from the reentry of microorganisms.

  WARNING

  The older-style rubber rings are no longer recommended. Although they are sometimes still available secondhand, the seal is no longer dependable enough to result in a safe product. You can find these rubber rings in some specialty canning stores; however, due to their novelty, they are expensive and sold in small quantities. Reserve this type of canning jar and kitschy design for your fun food gifts, not canning for a family's pantry.

STEAM CANNING: THE HOT NEW THING

A relatively new wrinkle to food preserving is the acceptance of *steam canning* as a safe variant of the water-bath method. In steam canning, filled jars are processed in an enclosed pot (specifically designed for the purpose) with just a bit of boiling water, using steam alone to create an environment that reaches 212 degrees. Steam canners are inexpensive and use far less water than traditional water-bath canners, meaning they're also faster. Only high-acid foods approved for water-bath canning can be processed using the steam method, and any food that requires more than 45 minutes to process should be saved for a conventional water-bath canner. This guideline ensures that the water does not boil off completely, although some steam canner models can run longer than that without going dry. If you are interested in steam canning, buy a good quality steam canner (Victorio makes several popular models), follow all of the manufacturer's directions, and use water-bath recipes from trusted sources.

CAN I WATER-BATH CAN IN MY INSTANT POT?

The programmable pressure cooker (like the ubiquitous Instant Pot) has become an indispensable fixture on kitchen countertops everywhere. It cooks quickly, it can sear and sauté foods, it can operate as a slow cooker, it steams rice, it can keep foods warm, it even has a one-button setting for making porridge (for those families of bears in a rush to leave their just-right houses, presumably).

But can the Instant Pot be used for water-bath canning? Well. . . maybe. Some manufacturers say it can be done, but with a few key caveats. For one, you must use a trivet to elevate the jars off the bottom of the pot insert to reduce the risk of breakage. This then limits the size of jars you can use, since the tops cannot touch the underside of the Instant Pot lid. Remember, too, that your water must stay at a rolling boil for the entire operation, and the Instant Pot's lid prevents you from seeing into it while the lid is on. You can set it for a certain amount of time and hope that the water inside is boiling, but is it? And if you leave the lid off, you might as well just use a regular pot on the stove.

Long story short, although plenty of bloggers add water-bath canning to the long list of ways they love to use their IP, you may decide the smarter move is to play it safe and stick with more proven methods and time-tested equipment.

Water-Bath Canning Step-by-Step

The following section guides you through the step-by-step process for creating delicious, high-quality, homemade treats for your family and friends.

REMEMBER

Always practice proper kitchen sanitation and cleanliness, carefully handle your food, and follow your recipe to the letter. Don't alter your recipe or skip any processing step.

Step 1: Getting your equipment ready

The first thing you do when canning is to inspect your equipment and get everything ready so that when you're done preparing the food (Step 2 in the canning process), you can fill your jars immediately.

Inspect your jars, lids, and screw bands

Always review the manufacturer's instructions for readying your jars, lids, and screw bands. Then inspect your jars, lids, and screw bands for any defects as follows:

- **Jars:** Check the jar edges for any nicks, chips, or cracks in the glass, discarding any jars with these defects. If you're reusing jars, clean any stains or food residue from them and then recheck them for any defects.
- **Screw bands:** Make sure the bands aren't warped, corroded, or rusted. Test the roundness of the band by screwing it onto a jar. If it tightens down smoothly without resistance, it's useable. Discard any bands that are defective or *out of round* (bent or not completely round).

  REMEMBER

  You can reuse screw bands over and over, as long as they're in good condition. And because you remove them after your jars have cooled, you don't need as many bands as jars.
- **Lids:** All lids must be new. Most lids aren't reusable (except for the Tattler brand). Check the sealant on the underside of each lid for evenness. Don't use scratched or dented lids. Defective lids won't produce a vacuum seal. Don't buy old lids from secondhand stores. Older lids will not seal properly.

Wash your jars, lids, and screw bands

After examining the jars for nicks or chips, the screw bands for proper fit and corrosion, and the new lids for imperfections and scratches, wash everything in warm, soapy water, rinsing the items well and removing any soap residue. Discard any damaged or imperfect items.

Get the kettle water warming

Fill your canning kettle one-half to two-thirds full of water and begin heating the water to simmering. Remember that the water level will rise considerably as you add the filled jars. Be sure to not overfill at this point.

TIP

Heat extra water in a teakettle or saucepan as a reserve. You want to make sure that the jars are covered with at least 1 to 2 inches of water. By adding preheated water, you don't have to wait for the entire canner to reheat before continuing.

Keep your equipment and jars hot while you wait to fill them

While you're waiting to fill your jars, submerge the jars and lids in hot, not boiling, water, and keep your screw bands clean and handy as follows:

- **Jars:** Submerge them in hot water in your kettle for a minimum of 10 minutes. Keep them there until you're ready to fill them.
- **Lids:** Submerge them in hot, not boiling, water in a saucepan. Keeping them separate from your jars protects the lid sealant.
- **Screw bands:** These don't need to be kept hot, but they do need to be clean. Place them where you'll be filling your jars.

Step 2: Readying your food

Always use food of the highest quality when you're canning. If you settle for less than the best, your final product won't have the quality you're looking for. Carefully sort through your food, discarding any bruised pieces or pieces you wouldn't eat in the raw state.

Follow the instructions in your recipe for preparing your food, such as removing the skin or peel or cutting it into pieces.

Similarly, prepare your food exactly as instructed in your recipe. Don't make any adjustments in ingredients or quantities of ingredients. Any alteration may change the acidity of the product, requiring pressure canning (see the next section) instead of water-bath canning to kill microorganisms.

REMEMBER

If your recipe doesn't tell you which processing method (water-bath canning or pressure canning) is appropriate for your food, don't guess. Instead, use litmus paper to test the pH level of your food (see the previous section). If your food has a pH of 4.6 or lower, use the water-bath canning method; if it has a pH of 4.7 or higher, use the pressure-canning method. Most fruits are naturally high in acid; pickled vegetables also fall into this category, making them safe for water-bath canning. You may change the acid level in low-acid foods by adding an acid, such as vinegar, lemon juice, or *citric acid,* a white powder extracted from the juice of acidic fruits such as lemons, limes, or pineapples. Some examples of altered low-acid foods are pickles made from cucumbers, relish made from zucchini or summer squash, and green beans flavored with dill. Today, tomatoes tend to fall into this category. They can be water-bath canned, but for safety's sake you add a form of acid to them.

REMEMBER

If your recipe states something specifically, it's there for a reason. If you don't follow the recipe instructions to the letter, your final results won't be what the recipe intended.

Step 3: Filling your jars

Add your prepared food (cooked or raw) and hot liquid to your prepared jars as soon as they're ready. Follow these steps:

1. **Transfer your prepared food into the hot jars, adding hot liquid or syrup if your recipe calls for it, and being sure to leave the proper headspace.**

   Use a wide-mouth funnel and a ladle for quickly filling your jars. You'll eliminate a lot of spilling and have less to clean from your jar rims. It also helps cleanup and prevents slipping if you place your jars on a clean kitchen towel before filling.

2. **Release any air bubbles with a nonmetallic spatula or a tool to free air bubbles. Add more prepared food or liquid to the jar after releasing the air bubbles to maintain the recommended headspace.**

   REMEMBER

   Before applying the two-piece caps, always release air bubbles and leave the headspace specified in your recipe. These steps are critical for creating a vacuum seal and preserving your food.

3. **Wipe the jar rims with a clean, damp cloth.**

   If there's one speck of food on the jar rim, the sealant on the lid edge won't make contact with the jar rim and your jar won't seal.

4. **Place a hot lid onto each jar rim, sealant side touching the jar rim, and hand-tighten the screw band.**

   Don't overtighten because air needs to escape during the sealing process.

Step 4: Processing your filled jars

With your jars filled, you're ready to begin processing. Follow these steps:

1. **Place the jar rack in your canning kettle, suspending it with the handles on the inside edge of the kettle.**

2. **Place the filled jars in the jar rack, making sure they're standing upright and not touching each other.**

   Although the size of your kettle seems large, don't be tempted to pack your canner with jars. Place only as many jars as will comfortably fit yet still allow water to move freely between them. And always process jars in a single layer in the jar rack.

WARNING

Never process half-pint or pint jars with quart jars because the larger amount of food in quart jars requires a longer processing time to kill any bacteria and microorganisms. If your recipe calls for the same processing times for half-pint and pint jars, you may process those two sizes together.

3. **Unhook the jar rack from the edge of the kettle, carefully lowering it into the hot water, and add water if necessary.**

   Air bubbles coming from the jars are normal. If your jars aren't covered by at least 1 inch of water, add boiling water from your reserve. Be careful to pour this hot water between the jars, instead of directly on top of them, to prevent splashing yourself with hot water.

   REMEMBER

   Make sure the tops of the submerged jars are covered with 1 to 2 inches of hot water. Add additional water from your reserve teakettle or saucepan to achieve this level.

4. **Cover the kettle and heat the water to a full, rolling boil, reducing the heat and maintaining a gentle, rolling boil for the amount of time indicated in the recipe.**

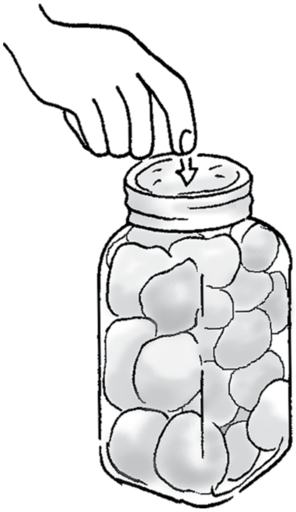
   Start your processing time after the water boils. Maintain a boil for the entire processing period.

   If you live at an altitude above 1,000 feet above sea level, you need to adjust your processing time. Check out "Adjusting Your Processing Times at High Altitudes" at the end of this section for details.

Step 5: Removing your filled jars and testing the seals

After you complete the processing time, immediately remove your jars from the boiling water with a jar lifter and place them on clean, dry, kitchen or paper towels away from drafts, with 1 or 2 inches of space between the jars — don't attempt to adjust the bands or check the seals — and allow them to cool completely. The cooling period may take 12 to 24 hours. Do not try to hurry this process by cooling the jars in any way. This may result in unsealed jars or cracked glass.

After your jars have completely cooled, test your seals by pushing on the center of the lid (see Figure 2-2). If the lid feels solid and doesn't indent, you have a successful vacuum seal. If the lid depresses in the center and makes a popping noise when you apply pressure, the jar isn't sealed. Immediately refrigerate unsealed jars, using the contents within two weeks or as stated in your recipe.



Test the seal by depressing the center of the lid of the completely cooled jar

FIGURE 2-2: Testing your jar seal.

REPROCESSING UNSEALED JARS

Jars may not seal for several reasons: You may have miscalculated the processing time, pieces of food may not have been cleaned from the jar rim, you may have left an improper amount of headspace, or the sealant on the lids may have been defective. The safest and easiest method for treating processed jars that didn't seal is to refrigerate the jar immediately and use the product within two weeks.

If you want to reprocess jars that didn't seal, you can do that. But keep in mind that reprocessing your food takes almost as much time as making the recipe from the beginning. The only time to consider reprocessing jars is if every jar in the kettle doesn't seal.

To reprocess unsealed jars, follow these steps:

1. Remove the lid and discard it.
2. Check the edge of the jar for damage.

   If the jar is damaged, discard the food in case a broken piece of glass fell into the food.
3. Discard any damaged jars.
4. Reheat the food.
5. Follow the step-by-step instructions in this chapter for filling your jars, releasing air bubbles, and processing your sterilized, filled jars.
6. Reprocess the filled jars for the recommended time for your recipe.
7. Check the seal after your jars have completely cooled.

Step 6: Storing your canned food

After you've tested the seal and know that it's good (see the preceding section), it's time to store your canned food. To do that, follow these steps:

1. **Remove the screw bands from your sealed jars.**
2. **Wash the sealed jars and the screw bands in hot, soapy water.**

   This removes any residue from the jars and screw bands.
3. **Label your filled jars, including the date processed.**
4. **Store your jars, without the screw bands, in a cool, dark, dry place.**

Adjusting Your Processing Times at High Altitudes

When you're canning at an altitude higher than 1,000 feet above sea level, you need to adjust your processing time (see Table 2-1). Because the air is thinner at higher altitudes, water boils below 212 degrees. As a result, you need to process your food for a longer period of time to kill any microorganisms that can make your food unsafe.

If you live higher than 1,000 feet above sea level, follow these guidelines:

- **For processing times of less than 20 minutes:** Add 1 additional minute for each additional 1,000 feet of altitude.
- **For processing times of more than 20 minutes:** Add 2 additional minutes for each 1,000 feet of altitude.

TIP

If you don't know the elevation of your city, check with your city offices, your public library, or your state or county cooperative extension service listed in your local telephone directory. Or check out `http://national4-hheadquarters.gov/extension/index.html`. Just enter your city and state in the box at the bottom of the page, click Submit, and scroll down to find the elevation of your city.

TABLE 2-1 High-Altitude Processing Times for Water-Bath Canning

Altitude (in feet)	For Processing Times Less Than 20 Minutes	For Processing Times Greater Than 20 Minutes, Add This
1,001–1,999	Add 1 minute	Add 2 minutes
2,000–2,999	Add 2 minutes	Add 4 minutes
3,000–3,999	Add 3 minutes	Add 6 minutes
4,000–4,999	Add 4 minutes	Add 8 minutes
5,000–5,999	Add 5 minutes	Add 10 minutes
6,000–6,999	Add 6 minutes	Add 12 minutes
7,000–7,999	Add 7 minutes	Add 14 minutes
8,000–8,999	Add 8 minutes	Add 16 minutes
9,000–9,999	Add 9 minutes	Add 18 minutes
Over 10,000	Add 10 minutes	Add 20 minutes

Canning Fresh Fruit (Yes, That Includes Tomatoes)

Canning fresh fruit is a great way to preserve large quantities of ripe fruit in a short period of time. When selecting your fruit, think fresh, fresh, fresh! The best fruit for canning is freshly picked, ripe fruit. If you don't grow your own fruit, maybe you have a homesteading friend who would share hers with you or trade for something you grow. Some growers offer a "pick your own" option in their growing area for a fee.

Fruit from your supermarket isn't the best choice because it's often picked before it's fully ripened in order to compensate for the time it takes to get the fruit from the field to the store shelf. Don't boycott your supermarket, just be finicky when selecting your fruit for canning.

The sooner you process your picked fruit, the better the texture and flavor of your final product. Your fruit can wait a few hours or overnight before you process it, but be sure to refrigerate it until you're ready.

REMEMBER

Almost all fresh fruits can well with these exceptions: bananas, lemons, limes, melons, persimmons, and strawberries.

Identifying the proper degree of ripeness

How do you know if your fruit is ripe? *Ripe* fruit is defined as being fully developed, or mature, and ready for eating. If you grow your own fruit, you can check its development and maturity daily.

To check the fruit's ripeness

- **Hold the fruit in the palm of your hand and apply gentle pressure with your thumb and fingers.** The fruit should be firm to the touch. If there's an impression in the fruit that doesn't bounce back, the fruit is overripe. If it's hard as a rock, it's underripe. Neither should be canned. If you're picking your fruit for canning, you can perform the same test, with a slight difference: Do it while the fruit's still attached to the tree.
- **Smell the fruit.** Ripe fruit has a rich, full fruit aroma. A peach should smell like a peach; an apple should smell like an apple. The fragrance should be strong enough to entice you to devour the fruit on the spot.

REMEMBER

Always use fruit picked directly from the bush or tree. Fruit collected from the ground (referred to as *dropped fruit* or *ground fruit*) is an indication that the fruit is overripe. Don't use it for canning.

Deterring discoloration

There's probably nothing more unattractive than a piece of perfectly ripe cut fruit that's *oxidized* or *discolored*, dark or brown. Discoloration primarily occurs in apples, apricots, nectarines, peaches, and pears but may occur in other fruits.

You can protect your fruit from oxidation by slicing it directly into one of the following *antioxidant solutions*, a liquid to keep your fruit from darkening:

- **An ascorbic acid or citric solution:** Make a solution with 1 teaspoon of lemon or lime juice in 1 cup of cold water, or use a commercial product, such as Ever-Fresh or Fruit-Fresh, available in most supermarkets. When using one of these products, follow the instructions on the container.

  Ascorbic acid or citric acid is simply vitamin C. It doesn't change the fruit flavor. It's sold in powder form and is usually found in drugstores.
- **Vinegar, salt, and water:** Make this solution with 2 tablespoons of vinegar (5 percent acidity), 2 tablespoons of salt (pickling or kosher), and 1 gallon of cold water. Don't leave your fruit in this solution longer than 20 minutes because the solution extracts nutrients from your fruit and changes its flavor.

After its dip in your antioxidant solution, you just rinse and drain your fruit before packing it into your prepared jars.

Raw pack and hot pack

Raw pack and *hot pack* refer to two methods of getting the product into the jars. Generally, both methods can be used for either water-bath canning or pressure canning (covered in Chapter 3 of this minibook). Whether you use one or the other is determined by the texture of the food and its tendency (or not) to not fall apart from a lot of cooking. Whether you raw-pack or hot-pack also affects the processing times of the foods. With a few exceptions, most fresh fruits may be packed raw or hot. Always start with clean, ripe fruit and follow your recipe instructions.

- **Raw pack:** A raw pack is the preferred method for fruits that become delicate after cooking, such as peaches and nectarines. This method is what it says: packing raw fruit into hot jars.
- **Hot pack:** Hot packing heats your fruit in a hot liquid before packing it into your prepared jars. The advantages of hot packing over raw packing include fitting more fruit into the jars because the fruit's softer and more pliable, using fewer jars because you can fit more fruit into the jars, and spending less time waiting for the water in your kettle to boil because the filled jars are hot in the middle.

Lining your jars with liquid

You always add liquid when canning fresh fruit. Your options are boiling water, sugar syrup, or fruit juice. Determining which liquid you use is up to you, but consider the final use for your canned fruit. For instance, if you're using your canned berries in a fruit cobbler, boiling water may be the better choice because you'll add sugar to the cobbler. If you'll be eating your canned fruit out of the jar, use a sugar syrup or fruit juice.

REMEMBER

After adding the hot liquid to your filled jars, you release any trapped air bubbles in the jar. If the headspace drops after releasing the air bubbles, add more liquid to maintain the proper headspace (refer to Chapter 1 of this minibook for information about headspace). If the fruit level drops, you need to add fruit.

Sugar syrups

Sugar syrup is simply a mixture of sugar and water. It adds flavor to your canned fruit, preserves its color, and produces a smooth, firm texture. Other sweeteners, such as honey, may be added in addition to or without the sugar.

SUGAR SYRUP RECIPE ALTERNATIVES

Although syrup of sugar and water is the most common liquid used when canning fresh fruit, you may use honey in place of or in addition to granulated sugar. Use a mild-flavored honey that won't detract from the natural flavor of your fruit. Here are some suggestions:

Type of Syrup	Sugar	Honey	Water	Syrup Yield
Light	1 cup	1 cup	4 cups	51½ cups
Light	None	1 cup	3 cups	4 cups
Medium	2 cups	1 cup	4 cups	6 cups
Medium	None	2 cups	2 cups	4 cups

Combine the syrup ingredients in a saucepan over medium heat, stirring the syrup to dissolve the sugar and/or the honey. After the liquid boils, keep it hot or refrigerate it up to two days. If you refrigerate your syrup, reheat it to a boil before adding it to your filled jars.

Remember: Honey and canned goods made with honey should never be fed to children under one year of age due to the danger of infant botulism.

Use these guidelines for making your sugar-syrup choice:

- **Super-light syrup:** This syrup adds the least number of calories. The sweetness level is the closest to the natural sugar level in most fruits.
- **Extra-light syrup:** Use this syrup for a sweet fruit, such as figs.
- **Light syrup:** This is best with sweet apples and berries.
- **Medium syrup:** This syrup complements tart apples, apricots, nectarines, peaches, and pears.
- **Heavy syrup:** Use this with sour fruit, such as grapefruit.

Table 2-2 offers you five concentrations of sugar syrup. Allow ½ to ¾ cup of liquid for each filled pint jar and 1½ cups of liquid for each filled quart jar of fruit. Bring your syrup ingredients to a boil in a saucepan over high heat; stir to dissolve the sugar.

TIP

Always prepare your hot liquid before you prepare your fruit. The liquid should be waiting for you; you shouldn't be waiting for your liquid to boil.

TABLE 2-2 Sugar Syrup Concentrations

Syrup Strength	Granulated Sugar	Water	Approximate Yield
Super-light	¼ cup	5¾ cups	6 cups
Extra-light	1¼ cups	5½ cups	6 cups
Light	2¼ cups	5¼ cups	6½ cups
Medium	3¼ cups	5 cups	7 cups
Heavy	4¼ cups	4¼ cups	7 cups

Water or fruit juice

Packing fresh fruit in boiling water or fruit juice produces fruit with a soft texture. Two good choices for fruit juices are unsweetened pineapple juice or white grape juice. Use water you like to drink, without minerals and not the sparkling variety.

REMEMBER

Always use the hot-pack method (see the "Raw pack and hot pack" section, earlier in this chapter) when using water or unsweetened fruit juice for your canning liquid.

Fresh Fruit Canning Recipes

This section features foods that are commonly grown in home gardens. The quantity guide for each fruit fills a 1-quart jar. If you're using pint jars, cut the quantity in half.

The recipes use the water-bath canning method. For detailed instructions on water-bath canning, filling and processing your jars, and releasing air bubbles, refer to the step-by-step guidelines earlier in this chapter. And for a more extensive list of fruits, download the *Complete Guide to Home Canning and Preserving,* Revised 2015, by the United States Department of Agriculture at `www.healthycanning.com/wp-content/uploads/USDA-Complete-Guide-to-Home-Canning-2015-revision.pdf`.

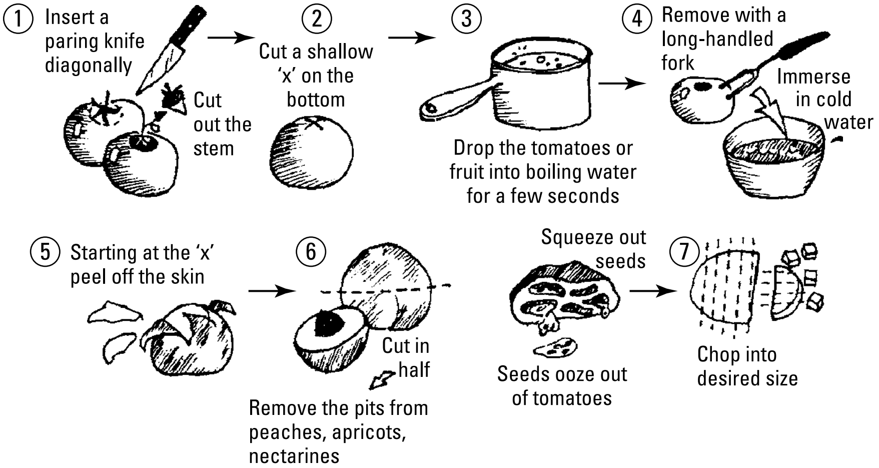
Apples

Choose apples suitable for eating or making pies. Prep is easy: Just peel and core the apples and then cut them into slices or quarters. To prevent discoloration, treat the fruit with an antioxidant (refer to "Deterring discoloration," earlier in this chapter).

Apricots, nectarines, and peaches

Peaches are a wonderful fruit, and by canning them yourself you can save a lot of money. Use a light syrup so that you can enjoy the full flavor of the peach. Trust us: Home-canned peaches are much nicer than the heavy sweetness you find in store-canned varieties.

Nectarines and apricots are just as tasty as peaches and have the benefit of not needing to be peeled, making them even easier to can. For a quick guide to peeling fruit, see Figure 2-3.



① Insert a paring knife diagonally
Cut out the stem
② Cut a shallow 'x' on the bottom
③ Drop the tomatoes or fruit into boiling water for a few seconds
④ Remove with a long-handled fork
Immerse in cold water
⑤ Starting at the 'x' peel off the skin
⑥ Cut in half
Remove the pits from peaches, apricots, nectarines
Squeeze out seeds
Seeds ooze out of tomatoes
⑦ Chop into desired size

FIGURE 2-3: Peeling soft-skinned fruit and tomatoes.

TIP

Apricots make a sunny-flavored addition to the winter meals. They make a great substitute for apples in an apple crisp recipe, too — you'll love the results!

Berries (except strawberries)

Canned berries have so many uses! You can use them to make smoothies or pies and as a sweet addition to your oatmeal. If your pantry is like ours, your berries will be the first things used up.

For canning, you want perfect, not soft or mushy, berries. Leave them whole. Wash and drain the berries (handling them as little as possible); remove any stems or hulls.

REMEMBER

Strawberries don't can well. During the processing, they turn mushy and lose their taste and red color. They do, however, freeze very well. See Chapter 5 of this minibook for complete instructions.

Depending on the type of berry, you'll use either the raw or hot pack method:

- **Raw pack:** Raw packing is best for soft berries, such as blackberries, boysenberries, and raspberries.
- **Hot pack**: Use this method for firmer berries, such as blueberries, cranberries, and huckleberries.

Tomatoes

Tomatoes are misunderstood. Are they a fruit or a vegetable? By definition, a *fruit* is a sweet, edible plant containing seeds inside a juicy pulp — which defines tomatoes perfectly. Each tomato variety has its own color, flavor, and texture. Roma or paste tomatoes and slicing varieties are all used for canning. Paste varieties simply have less juice and, therefore, require less cooking to remove excess water for paste and thick sauces. You can use both interchangeably, but cooking times will vary.

REMEMBER

Not all tomato varieties are suitable for canning due to their lack of taste and mass-production genetics. Stick with those that boast good canning results on the plant's tag or use a proven Heirloom variety. Some varieties that work well include Ace, Amish paste, Homestead 24, and Rutgers.

As always, choose nice, ripe, unblemished tomatoes. And to ensure the proper acidity level for your variety (4.6 or lower), add an acid, such as bottled lemon juice or powdered citric acid: Add 2 tablespoons lemon juice per quart jar or 1 tablespoon lemon juice per pint. If you're using citric acid, add ½ teaspoon per quart and ¼ teaspoon per pint.

THE BEST THING YOU'RE NOT DOING WITH TOMATOES: HOMEMADE PASTE

Tomato paste is packed with flavor, and if you're overrun with tomatoes, the Tomato Paste recipe in this chapter is the answer because it uses *a lot* of fruit! You can use this thick paste as-is for pizza (it's only slightly less thick than store bought but just as rich and fabulous); simply add your seasonings right on top. Your family will love the extra tomato taste. You can also add this paste to soups for amazing flavor and extra vitamins. Use paste or plum tomatoes, which have much less extra water to cook off.

Canned Apples

PREP: 15 MIN	PROCESSING: 20 MIN	YIELD: 8 PINTS OR 4 QUARTS

INGREDIENTS

12 pounds apples

Sugar syrup, light

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Wash, core, and peel your apples; then slice them into ¼-inch pieces or cut them into even chunks. Meanwhile, bring the sugar syrup to a boil.

3 Pack apples firmly into hot jars and pour boiling hot sugar syrup over the apples, leaving ½-inch headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a water-bath canner for 20 minutes for pints and quarts from the point of boiling.

5 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

PER ½-CUP SERVING: *Calories 137 (From fat 4); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 36g (Dietary fiber 3g); Protein 0g*

NOTE: Canned apples are wonderful for apple crisp, breads, and other recipes calling for slices or chunks of fruit.

NOTE: Use any crisp, tart apple that ripens in the fall. Summer-ripened apples tend to be softer and won't hold up well to canning.

VARY IT! For a sweeter canned apple, try a medium syrup instead.

Apple Pie Filling

PREP: 15 MIN	COOKING: 45 MIN	PROCESSING: 25 MIN	YIELD: 6 PINTS

INGREDIENTS

6 pounds apples

2 cups sugar

2 teaspoons cinnamon

½ teaspoon nutmeg

2 tablespoons lemon juice

1 Peel and slice or cube the apples. Place the apples and the other ingredients into a heavy pan. Allow the mixture to stand about 30 minutes or until it becomes juicy.

2 While the apples are standing, prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

3 Cook the apple mixture over medium heat until the apples are softened, about 7 minutes.

4 Ladle the pie filling into the pint jars, leaving ¼-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5 Process the filled jars in a water-bath canner for 25 minutes from the point of boiling.

6 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

NOTE: To thicken this filling to just the right consistency for a pie, add 1 tablespoon of flour to the filled pie before adding the top crust.

VARY IT! Substitute or add to the spices listed to create the pie your family likes.

PER ½-CUP SERVING: *Calories 121 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 31g (Dietary fiber 2g); Protein 0g*

Applesauce

PREP: 15 MIN	COOKING: 1 HR	PROCESSING: 20 MIN	YIELD: 4 QUARTS

INGREDIENTS

10 pounds apples, cut in half

2½ cups sugar

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2. Cut the apples in half (don't peel or core them) and place them in a 12-quart pot. Add enough water to cover the bottom of the pot and to keep the apples from scorching. Cook the apples over medium heat until they're soft, about 20 minutes. Press the softened apples through a food mill or sieve to remove the skins and seeds.

3. Return the apple purée to the pot and add the sugar. Bring the mixture to a boil, stirring often to prevent scorching.

4. Ladle the hot applesauce into your prepared jars, leaving ½-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5. Process the filled jars in a water-bath canner for 20 minutes from the point of boiling.

6. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

TIP: For a richer flavor, use a variety of apples.

TIP: To help prevent scorching, use a stovetop heat diffuser under the pot.

VARY IT! Try adding cinnamon and cloves for a spicy version.

PER ½-CUP SERVING: *Calories 129 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 34g (Dietary fiber 2g); Protein 0g*

Canned Apricots, Nectarines, and Peaches

PREP: 15 MIN	PROCESSING: PINTS, 25 MIN; QUARTS, 30 MIN	YIELD: 8 PINTS OR 4 QUARTS

INGREDIENTS

10 pounds apricots, 10 pounds nectarines, or 12 pounds peaches

Sugar syrup, light

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Wash your fruit. To prepare peaches, peel them; then cut them in half and remove the pits (see Figure 2-3). To prepare nectarines or apricots, simply cut them in half and remove the pits. Meanwhile, bring the sugar syrup to a boil.

3 Pack the fruit firmly into hot jars and pour boiling hot sugar syrup over fruit, leaving ½-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a water-bath canner for 25 minutes (pints) or 30 minutes (quarts) from the point of boiling.

5 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

(continued)

VARY IT! To make a sweeter canned fruit, use a medium syrup.

TIP: To make peaches easy to peel, blanch them to loosen the skin: Dip them in boiling water for 30 seconds and then dip them in cold water.

PER ½-CUP SERVING APRICOTS: *Calories 118 (From fat 5); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 2mg; Carbohydrates 29g (Dietary fiber 3g); Protein 2g*

PER ½-CUP SERVING NECTARINES: *Calories 118 (From fat 5); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 29g (Dietary fiber 2g); Protein 1g*

PER ½-CUP SERVING PEACHES: *Calories 88 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 4mg; Carbohydrates 23g (Dietary fiber 2g); Protein 1g*

Canned Raspberries

PREP: 15 MIN	PROCESSING: PINTS, 15 MIN; QUARTS, 20 MIN	YIELD: 8 PINTS OR 4 QUARTS

INGREDIENTS

12 pounds raspberries

Sugar syrup, light

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Wash the berries gently in cold water to firm them and remove any stems or hulls. Meanwhile, bring the sugar syrup to a boil.

3 Pack berries loosely into your prepared jars and pour boiling hot sugar syrup over them, leaving ½-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook), adding more sugar syrup as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a water-bath canner for 15 minutes (pints) or 20 minutes (quarts) from the point of boiling.

5 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

NOTE*:* Use this recipe to can any other soft berry, such as boysenberries or blackberries.

VARY IT! For sweeter canned berries, use medium syrup.

PER ½-CUP SERVING: *Calories 138 (From fat 8); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 34g (Dietary fiber 12g); Protein 2g*

Canned Blueberries

PREP: 20 MIN	PROCESSING: PINTS, 15 MIN; QUARTS, 20 MIN	YIELD: 8 PINTS OR 4 QUARTS

INGREDIENTS

10 pounds blueberries

Sugar syrup, light

Boiling water

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2. Wash the berries gently in cold water to firm them and remove any stems or hulls.

3. Measure the berries into a saucepan and add ½ cup sugar for each quart of berries. Bring the mixture to a boil over medium-high heat and stir occasionally to prevent sticking. In a large pot, bring water for your reserve to a boil.

4. Ladle the hot berries and liquid into your prepared jars, adding boiling water if there isn't enough liquid to fill the jars, leaving ½-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook), adding more berries and water as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5. Process the filled jars in a water-bath canner for 15 minutes (pints) or 20 minutes (quarts) from the point of boiling.

6. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

NOTE: Follow the same directions for any other type of hard berry.

VARY IT! For sweeter canned berries, use medium syrup.

PER ½-CUP SERVING: *Calories 124 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 2mg; Carbohydrates 32g (Dietary fiber 6g); Protein 1g*

Canned Tomatoes

PREP: 15 MIN	PROCESSING: PINTS, 35 MIN; QUARTS, 45 MIN	YIELD: 6 PINTS OR 4 QUARTS

INGREDIENTS

12 pounds whole tomatoes

Bottled lemon juice or citric acid

Canning salt (optional)

Boiling water

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2. Wash and peel the tomatoes. (To make peeling tomatoes easier, blanch them first to loosen the skins: Dip them in boiling water for 30 seconds and then into cold water.) After peeling, cut the larger tomatoes into halves or quarters.

3. Place the tomatoes into your prepared canning jars, pressing them to release their juice. (Use a canning funnel to keep the rims clean.) To each pint jar, add 1 tablespoon lemon juice or ¼ teaspoon citric acid and, if desired, ½ teaspoon salt. To each quart jar, add 2 tablespoons lemon juice or ½ teaspoon citric acid and, if desired, 1 teaspoon salt. If there's not enough juice to cover the tomatoes, add boiling water to the jars, leaving ½-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook), adding more tomatoes as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4. Process the filled jars in a water-bath canner for 35 minutes (pints) or 45 minutes (quarts) from the point of boiling.

5. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

TIP: Use wide-mouth pints or quart jars for ease in filling. Although not necessary, they will make the entire process go faster and with less mess.

PER ½-CUP SERVING: *Calories 44 (From fat 6); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 19mg; Carbohydrates 10g (Dietary fiber 2g); Protein 2g*

Tomato Paste

PREP: 15 MIN	COOKING: 1 HR, PLUS 3 HR	PROCESSING: 30 MIN	YIELD: 16 HALF-PINTS

INGREDIENTS

16 pounds plum or paste tomatoes, cubed

3 cups sweet pepper, chopped

2 bay leaves

2 tablespoons salt

3 cloves garlic

Bottled lemon juice or citric acid

1. Combine all ingredients in a 6-quart pot and cook slowly over medium heat for 1 hour, stirring frequently to prevent sticking. Remove the bay leaves and press the mixture through a food mill or sieve. Return the mixture to the pot and continue to cook for another 3 hours over medium-low heat, stirring often.

2. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

3. Pour the hot mixture into your canning jars, leaving ¼-inch headspace. Add ½ tablespoon lemon juice or ⅛ teaspoon citric acid to each half-pint jar. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook), adding more of the mixture as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4. Process the filled half-pint jars in a water-bath canner for 30 minutes from the point of boiling.

5. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

TIP: To check for sauce thickness, put a spoonful of sauce onto the center of a plate. Wait for 60 seconds and see if water seeps from it. If so, cook for 30 minutes more and recheck.

PER ½-CUP SERVING: *Calories 48 (From fat 6); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 455mg; Carbohydrates 11g (Dietary fiber 2g); Protein 2g*

Jam, Chutney, Relish, and Salsa Recipes

For many, a batch of homemade jam is their first tentative step into the world of water-bath canning. From there, it's just a short hop, skip, and jump to versatile fruit accompaniments such as chutneys, relishes, and salsas that can be preserved and used many months later to dress up your favorite foods at any meal. The following section gets your creative juices flowing and then follows up with recipes for great ways to enjoy fresh fruit all year long.

Jamming out

Making sweet spreads like jams, jellies, and marmalades is basic chemistry, using exact proportions of fruit and sugar, cooking the two, and sometimes adding acid or pectin.

Pectin is a natural, water-based substance that's present in ripe fruit. It's essential for thickening jams, jellies, and other types of preserves. Some recipes add commercial fruit pectin when more than the naturally occurring amount of pectin is needed (like when you want to thicken a fruit juice into a jelly). If your recipe does include such an ingredient, you'll see the kind of pectin (powdered or liquid) listed.

WARNING

Never alter the amount of sugar your recipe calls for or use sugar substitutes. Exact amounts of sugar, fruit, and pectin are a must for a good *set* — that is, a consistency that isn't too thick to spread or too runny. Any alteration or adjustment to the recipe upsets the perfect chemical balance and adversely affects your spread by producing inferior results. If you want more of the same recipe, make it twice. If you would like to use less sugar, find another recipe that uses your desired amount.

Pectin is available in two forms: liquid and powdered (dry). Although both products are made from fruit, they're not interchangeable. Be sure to use the correct type and amount of pectin your recipe calls for.

Using liquid fruit pectin

Liquid pectin is usually made from apples. Today, a box contains two 3-ounce pouches. The most common brand is Certo.

TECHNICAL STUFF

Liquid fruit pectin was originally sold in 6-ounce bottles. Older recipes may call for "one-half of a bottle." If you read a pouch of liquid pectin today, it states, "1 pouch equals ½ bottle."

Because you have to add your liquid pectin at the specified time and temperature, have it at the ready: Cut off the top of the pouch and stand it in a measuring cup or other container to keep it from spilling (see Figure 2-4). Then, when it's time to add the liquid pectin, add it all at the same time, squeezing the pouch with your fingers like you do to get the last bit of toothpaste out of the tube.

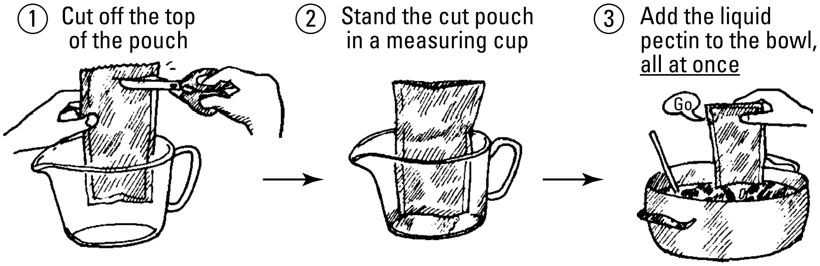

① Cut off the top of the pouch
② Stand the cut pouch in a measuring cup
③ Add the liquid pectin to the bowl, all at once
Go

FIGURE 2-4: Getting a pouch of liquid pectin ready.

Using powdered (dry) fruit pectin

Powdered pectin is made from citrus fruits or apples. It comes in a box similar to a gelatin- or pudding-mix box and contains 1¾ ounces (the most commonly used size) or 2 ounces. Use the size stated in your recipe ingredients, and add it before you heat the fruit mixture.

In addition to different sizes, powdered pectin comes in two varieties: fruit pectin for homemade jams and jellies, and fruit pectin for lower-sugar recipes. Use the variety your recipe calls for; they're not interchangeable.

Making great accompaniments

Condiments and accompaniments are to food what accessories are to clothing. They're not necessary, but they enhance what's there. They cover a wide range of flavors including savory, spicy, salty, sweet, or a combination. Think of them as the bright spot on an otherwise dull winter plate. And they're a great way to incorporate more of the fruits, veggies, and herbs from your homestead into your everyday meal prep!

The Green Tomato Chutney recipe is a great way to use your green tomatoes. It produces a super-thick chutney that makes a great gift and looks lovely on the shelf. Although you'll be eager to try the chutney as soon as it's done, let it sit for one month before you use it, longer if you can to help develop the fine flavor. This recipe uses half-pint jars — the perfect size for a picnic basket!

Relish wears many hats and complements a wide variety of foods, from hamburgers and hot dogs, to meat and poultry. Relish is a cooked mixture of fruit or vegetables preserved with vinegar. Flavor can be sweet to savory and hot to mild with textures ranging from smooth to finely chopped or chunky. Including an overnight soak, this unique relish takes two days to make.

Strawberry-Rhubarb Jam

PREP: 45 MIN	PROCESSING: 20 MIN	YIELD: 3 PINTS

INGREDIENTS

4 cups strawberries, crushed

2½ cups chopped rhubarb

¼ cup lemon juice

One 1.75-ounce package pectin powder

6 cups sugar

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Hull and crush the strawberries. Clean the rhubarb; trim the ends and remove the leaves. Cut the rhubarb into ½-inch pieces.

3 Combine the strawberries, rhubarb, lemon juice, and pectin powder in a large saucepan. Bring the mixture to a boil over medium-high heat. Add the sugar, stirring to dissolve. Return the mixture to a full, rolling boil and boil hard for 1 minute. Remove the saucepan from the heat. Skim any foam from the surface with a foam skimmer, if necessary.

4 Ladle the boiling-hot jam into your hot jars, leaving ¼-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook), adding more jam as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5 Process the filled pint jars in a water-bath canner for 20 minutes from the point of boiling. (Note: It doesn't matter if you have a less-than-full canner. Simply arrange the jars so that they're evenly spaced, if possible.)

6 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

PER 1-TABLESPOON SERVING: *Calories 53 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 1mg; Carbohydrates 14g (Dietary fiber 0g); Protein 0g*

Green Tomato Chutney

PREP: 1 HOUR 15 MIN	PROCESSING: 10 MIN	YIELD: 8 HALF-PINTS

INGREDIENTS

4 pounds green tomatoes, chopped

2 medium onions, chopped

1½ green apples, peeled, cored, and chopped

1 cup golden raisins

1 teaspoon salt

½ teaspoon ground red pepper

1 teaspoon allspice

1 teaspoon curry, or to taste

1 cup brown sugar

2 cups cider vinegar

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)
2. Place all the ingredients in a 6-quart pot, and simmer on medium heat until the mixture is thick and rich, the consistency of very thick, chunky applesauce, about 45 minutes. Stir often to prevent scorching.
3. Ladle the mixture into the prepared jars. Leave ¼-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook), adding more mixture as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.
4. Process the filled half-pint jars in a water-bath canner for 10 minutes from the point of boiling.
5. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

NOTE: Although you'll be eager to try the chutney as soon as it's done, let it sit for one month or longer before you use it, to help develop the fine flavor.

PER 1-TABLESPOON SERVING: *Calories 16 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 21mg; Carbohydrates 4g (Dietary fiber 0g); Protein 0g*

Summer Squash Relish

PREP: 45 MIN	SOAKING: 12 HR	PROCESSING: 15 MIN	YIELD: 6 PINTS

INGREDIENTS

5 pounds (about 10 to 12) medium zucchini

6 large onions

½ cup kosher or pickling salt

Cold water to cover the vegetables (about 4 to 5 quarts)

2 cups white wine vinegar

1 cup granulated sugar

Two 4-ounce jars pimientos, undrained

2 teaspoons celery seed

1 teaspoon powdered mustard

½ teaspoon ground cinnamon

½ teaspoon ground nutmeg

½ teaspoon freshly ground black pepper

1 On the first day, finely chop the zucchini and onions. (If you're using a food processor, chop them in three batches.) Place the vegetables in a 5- to 6-quart mixing bowl and sprinkle them with the salt. Add water to cover them, place a cover on the bowl, and refrigerate overnight or at least 12 hours.

2 On the second day, drain the vegetables in a colander. Rinse well with running water; drain. Transfer the vegetables to a 5- to 6-quart pot. Add the vinegar, sugar, pimientos, celery seed, mustard, cinnamon, nutmeg, and pepper. Stir to combine.

3 Bring the vegetables to a boil over medium-high heat, stirring occasionally. Reduce the heat and simmer, uncovered, until the mixture reduces to 3 quarts, about 30 to 40 minutes. Stir the vegetables every 10 minutes to prevent sticking. The zucchini color turns a dull shade of green.

4 While your relish is cooking, prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

5 Spoon the hot relish into your prepared jars, leaving ¼-inch headspace. Compact the relish with a spoon to release any air bubbles. Add more relish as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

6 Process your filled jars in a water-bath canner for 15 minutes from the point of boiling.

(continued)

7. Remove the jars from the boiling water with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within 2 months.

VARY IT! Use 3 pounds of zucchini and 2 pounds of patty pan or yellow crookneck squash.

PER 2-TABLESPOON SERVING: *Calories 16 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 14mg; Carbohydrates 4g (Dietary fiber 1g); Protein 0g*

Jalapeño Salsa

PREP: 30 MIN	PROCESSING: 15 MIN	YIELD: 3 PINTS

INGREDIENTS

2 pounds tomatoes, peeled and chopped, to measure 3 cups

7-ounce can diced jalapeño chilies or 12 fresh jalapeño chilies, finely chopped, seeds removed

1 onion, peeled and chopped

6 garlic cloves, minced

2 tablespoons finely chopped fresh cilantro

2 teaspoons ground oregano

1½ teaspoons kosher or pickling salt

½ teaspoon ground cumin

1 cup cider vinegar

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Place all the ingredients in a 5- to 6- quart pot. Bring the mixture to a boil over high heat, stirring to combine. Reduce the heat to low; simmer, uncovered, for 10 minutes.

3 Ladle your hot salsa into the prepared jars; leaving ¼-inch headspace. Release any air bubbles with a nonreactive utensil (refer to Chapter 1 of this minibook), adding more salsa as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a water-bath canner for 15 minutes from the point of boiling.

5 Remove the jars from the boiling water with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (see the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within 2 months.

PER 2-TABLESPOON SERVING: *Calories 6 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 99mg; Carbohydrates 2g (Dietary fiber 0g); Protein 0g*

IN THIS CHAPTER

- **Demystifying the why's and how's of pressure canning**
- **Making popular vegetables last with step-by-step instructions for pressure canning**

Chapter 3

Pressure Canning

Pressure canning is a process for preserving food with a low-acid content by exposing the food to a high temperature (240 degrees) under a specific pressure for a specific period of time in a specific type of pot: the pressure canner.

People who hear someone talking about pressure canning often ask, "Is it safe?" or "Won't the pressure canner explode?" These concerns are certainly valid ones, but rest assured, when you know the right way to use a pressure canner, you can safely process a variety of low-acid foods. While pressure cookers and canners of the past may have once exploded if not closed properly, the new generation of canners and cookers are much lighter in weight and have built-in safety features that release steam if the pressure gets too high. None of your grandparents' pressure cooking equipment had this.

This chapter leads you step by step through the pressure-canning process, including an explanation of pressure canning, what to look for when purchasing a pressure canner, and how to fill your canner and safely process your filled jars. You also discover recipes for making those homegrown veggies last well beyond the harvest.

Understanding the Fuss about Low-Acid Foods

Low-acid foods contain little natural acid and require more care during the canning process than other types of foods. (If you're a techie, note that low-acid foods are foods with a *pH factor* — that's a measure of acidity in food — higher than 4.6.) Foods in this category include vegetables, meats, poultry, seafood, and combination foods (such as soups, meat sauces, and salsas) that contain low-acid and high-acid ingredients. Exceptions to these low-acid foods sometimes include tomatoes, which are really a fruit and can be water-bath canned (although for safety's sake, you still add acid to tomatoes) and vegetables converted to high-acid foods such as sauerkraut, pickles, or pickled vegetables (discussed in Chapter 4 of this minibook).

WARNING

Low-acid foods require pressure canning to kill microorganisms that are harmful if not destroyed before ingesting the food. Pressure canning at 240 degrees kills the botulism bacteria. If this temperature isn't achieved and the bacteria isn't destroyed, one taste of this spoiled food can kill you. And to make matters worse, these botulism-causing bacteria are odorless, have no taste, and actually thrive in low-acid foods that are in a moist environment and not in contact with air — the exact condition provided in a jar of canned food. Simply boiling food on the stovetop will not kill any botulism and should not be considered a safety step.

REMEMBER

In a water-bath canner, the temperature of boiling water never increases above 212 degrees (the boiling point for water). While 212 degrees is fine for water-bath canning high-acid foods, it's *not* sufficient to safely can low-acid foods. For that, you need to superheat your filled jars to a temperature of 240 degrees, which only a pressure canner can achieve. Be sure to use a pressure canner that's approved for pressure canning by the United States Department of Agriculture (USDA).

Choosing a Pressure Canner

A *pressure canner,* shown in Figure 3-1, is a heavy kettle made for processing home-canned food. It includes a locking, tight-fitting cover that makes the kettle airtight. The purpose of pressure canning is to sterilize the food by destroying hard-to-kill microorganisms, especially the bacteria that cause botulism.

For the home canner, a pressure canner with a capacity of 16 to 22 quarts is generally adequate. This size holds seven 1-quart jars and permits good air circulation during processing. The cost of a pressure canner may vary from $100 on the low end to upward of $600, depending on size, features, and reputation of the manufacturer.

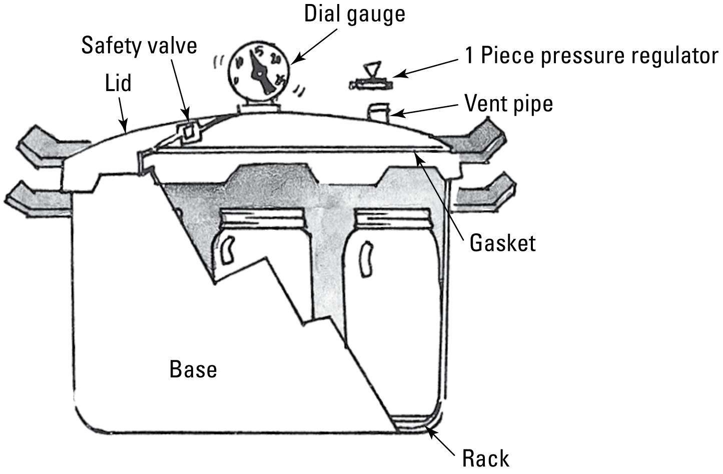


FIGURE 3-1: A pressure canner.

Don't confuse pressure canners with pressure cookers; they are *not* interchangeable. A pressure canner is used to process and sterilize home-canned, low-acid foods. The purpose of a pressure cooker is to cook food fast. Pressure cookers are not large enough to hold the jars and the amount of water necessary to can properly. They also do not have pressure gauges that allow you to maintain the constant pressure required.

WARNING

Attention Instant Pot fanatics! At the time of this writing, instant pressure cookers (like the Instant Pot) have *not* been approved by the USDA for pressure canning. This type of cooker is regulated by a pressure sensor, not a thermometer, so there is no way to ensure that the interior is getting hot enough to safely pressure-can food. But beware: some models boast a "canning" feature and even have a "canning" button on their control panels. (Water-bath canning of foods such as pickles and jams is technically possible, but comes with challenges. See the sidebar "Can I water-bath can in my Instant Pot?" in Chapter 2 of this minibook.) The technology in these machines is evolving rapidly to meet consumers' demands, so future models may one day make great pressure canners. But for now, follow the guidelines laid out here for pressure canning, and save your Instant Pot for weeknight dinner prep.

The following section highlights different features of various pressure canners so that you can determine which ones you prefer. The type of pressure canner you choose doesn't matter as long as the model is made and approved for processing home-canned foods.

REMEMBER

No matter which type or size of pressure canner you choose, the goal is always the same: to superheat and process low-acid food at a high temperature (240 degrees) that destroys microorganisms.

Covers

You can find two types of covers for pressure canners: a lock-on cover and a metal-to-metal cover that's attached with wing nuts. The difference is that one has a rubber gasket to ensure an airtight seal; the other one doesn't. For a beginner, a lock-on cover is the easiest and most fail-proof to use.

Lock-on cover

A *lock-on cover* (see Figure 3-2) usually has a rubber gasket between the cover and the base unit to ensure to the airtight seal. To securely fasten the cover to the pressure canner, rotate the cover on the base to the locked position (matching up the handles or matching arrows or other markings on the unit) or with a type of clamping handle. To ensure that the pressure canner is properly closed, refer to your owner's manual for precise instructions.

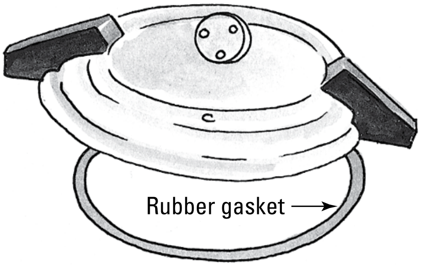


FIGURE 3-2: A lock-on cover and rubber gasket.

WARNING

Over time, the rubber gasket may stretch out of shape or begin to rot and deteriorate (indicated by cracking or splitting). If your gasket is in this condition, don't use your pressure canner until you've replaced the gasket. A gasket in poor condition may prevent the canner from reaching the pressure required to superheat the food and kill microorganisms.

TIP

After each use, carefully remove the gasket from the cover. Thoroughly wash the gasket in hot, soapy water and dry it well. After the gasket is completely dry, put it back on the cover so that your pressure canner is always ready for use. Some manufacturers suggest lightly coating the gasket with cooking oil, but check your owner's manual before doing this.

Metal-to-metal cover with wing nuts

A *metal-to-metal cover* (see Figure 3-3) doesn't require a gasket to create a tight seal; instead, this pressure canner uses wing nuts. To secure a cover with wing nuts, tighten two wing nuts on opposite sides of the canner at the same time by hand (don't use a tool and don't tighten one side at a time). Repeat this process for the remaining wing nuts.

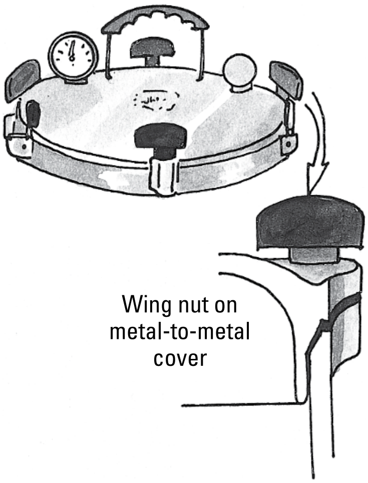

Wing nut on metal-to-metal cover

FIGURE 3-3: A metal-to-metal cover with wing nuts.

REMEMBER

Never tighten one nut at a time because uneven results will occur. If your wing nuts aren't tightened properly, as soon as the pressure starts to rise, water leaks out. You then have to carefully remove the canner from the heat and wait for the pressure to subside before untightening and retightening all over again.

Every year, check for nicks and dents in the rim of both the lid and the canner itself. These imperfections will prevent the canner from making a seal.

Gauges

Gauges are located on the top of the pressure canner cover and regulate pressure within the canner. Two types of gauges are available: a weighted gauge and a dial gauge (see Figure 3-4). A dial gauge indicates the pressure of the canner, while a weighted gauge indicates and regulates the pressure of the contents. If you're a beginner, go with the weighted gauge.

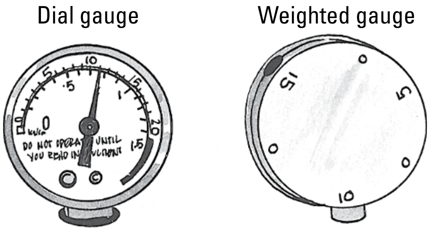

Dial gauge
Weighted gauge
DO NOT OPERATE UNTIL YOU READ INSTRUCTIONS
15
5
10
0

FIGURE 3-4: Pressure canner gauges.

Weighted gauge

A *weighted gauge* is simple and accurate. It's sometimes referred to as an *automatic pressure control* or a *pressure regulator weight.* This gauge allows you to cook without looking: The weighted gauge automatically controls the pressure by jiggling as the canner reaches the correct pressure. When the pressure in the canner is too high, the weighted gauge jiggles faster, and may hiss, as it releases excess steam from the canner.

A weighted gauge has a preset control that needs no service or testing to ensure an accurate pressure measurement. The pressure settings are indicated by three numbers marked on the gauge (refer to Figure 3-4): 5, 10, and 15. The numbers represent the pounds per square inch (psi) of pressure created by the trapped steam from the boiling water in the pressure canner.

REMEMBER

The most common pressure used in pressure canning is 10 pounds, but never guess — always refer to your recipe.

Dial or steam pressure gauge

A *dial* or *steam pressure gauge* (refer to Figure 3-4) is a numbered instrument that indicates the pressure in the canner. You have to watch dial gauges carefully to be sure they don't rise too high, and you have to turn the heat up or down to keep the pressure in the right area.

Unlike the weighted gauge that requires no service, you must check this control for accuracy each season or at least once every year of use. To obtain service, refer to your owner's manual for service locations, check with the store where you purchased the canner, or contact your local cooperative extension services.

WARNING

If your annual service shows that your dial gauge is off by 5 or more pounds, replace the gauge. An inaccurate reading may not produce the temperature required to kill all microorganisms. You can have your canner checked for a nominal fee, if not free, at your local hardware store or county extension office.

Vent tube, pipe vent, or petcock

Whatever the name of this feature — *vent tube, pipe vent,* or *petcock* — the function is the same (see Figure 3-5). These terms refer to an opening in the pressure-canner cover for emitting steam. Sometimes the weighted gauge sits on the vent tube.

REMEMBER

To work properly, the vent tube opening cannot be obstructed with food or other matter. Obstructions restrict the optimum pressure and temperature required for your recipe. To check the vent for obstructions, hold it up to the light. If the vent appears to be clogged, insert a piece of wire (or other item suggested in your owner's manual) into the tube. Rinse the vent with hot water. Repeat the procedure if you still see an obstruction.

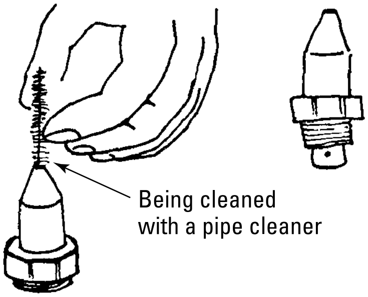


FIGURE 3-5: A vent tube.

Overpressure plug

An *overpressure plug* (see Figure 3-6) releases (pops up) if too much pressure exists in your pressure canner due to a blocked vent tube. The overpressure plug is a safety feature that's solely for your protection. If you follow the instruction manual for your pressure-canner operation, chances are this plug will never be used.

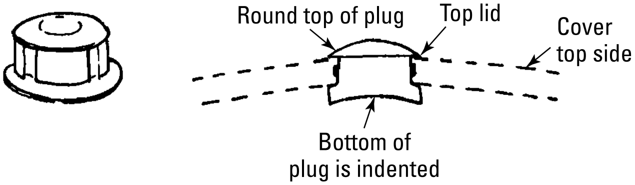


FIGURE 3-6: An overpressure plug.

Rack

Your pressure canner should come with a rack. (If the rack is missing, contact the store where you made your purchase.) The perfect rack lies flat in the bottom of your canner and has lots of holes and openings that allow steam to circulate around your filled jars. Figure 3-7 is an example of a canner rack.

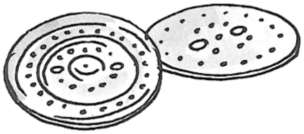


FIGURE 3-7: A rack for holding jars in the bottom of your pressure canner.

TIP

Make sure your rack is stable when you place it in the bottom of the canner. A stable rack holds jars in place, thus preventing the jars from tipping, touching other jars, or touching the sides of the canner.

Pressure Canning Step-by-Step

To ensure a processed product of high quality, free from microorganisms, be sure to follow each step in this section. Don't omit or modify any part. You may spend a bit more time canning low-acid foods with a pressure canner than you would canning high-acid foods in a water-bath canner, but the end result is worth the extra effort.

TIP

If you've never used a pressure canner before, do a trial run with no jars: Heat up the canner and go through the steps of pressurizing and depressurizing to familiarize yourself with the sounds the pressure canner makes as it builds and then releases pressure. You'll hear the steam escaping, the weight gauge shaking, and the ticking of the canner as it heats and cools; if you don't know what to expect, you could misinterpret these noises as scary or wrong.

Step 1: Gearing up

At least a couple of weeks before you want to use it, check your pressure canner and replace any gasket or missing part, have a dial gauge checked professionally, and replace a missing manual. Also count your jars and two-piece caps and examine the jars for nicks or chips, the screw bands for proper fit and corrosion, and the new lids for imperfections and scratches. It's also a good idea to select your recipe, and inventory your pantry for any nonperishable ingredients, adding any needed items to your shopping list. Your goal is to have all the supplies you need and your pressure canner in good working order on the day you're ready to can.

REMEMBER

Preparing your pressure canner before the actual canning season means you will not find the store out of supplies and the extension agent too busy to check your gauge in time to begin canning when the produce is ripe.

On the actual canning day, get your tools ready by following these steps:

1. **Assemble your prechecked equipment and utensils.**

   In addition to your pressure canner and the standard canning supplies (jars with two-piece lids), other items can make your canning easier: a food scale, extra pans for cooking your veggies and keeping a water reserve on hand, a wide-mouth funnel, and so on.

2. **Wash your jars and screw bands in warm, soapy water, rinsing well to remove any soap residue.**

   Double-check for nicks and dents and discard any damaged items.

3. **Place your clean jars and lids in a kettle of hot — not boiling — water until you're ready to fill them.**

   WARNING

   Never boil the lids because the sealant material may be damaged and won't produce a safe vacuum seal.

4. **Ready your canner by filling it with 2 to 3 inches of water and heating the water.**

Step 2: Preparing your food

Always start with food of the highest, freshest quality. Food that's spoiled or bruised doesn't improve in quality during the pressure-canning process! To prepare your food for pressure canning, follow these steps:

1. **Wash all food prior to packing it in the jars or precooking it.**
2. **Thoroughly cut away all evidence of spoilage or discard any inferior products.**
3. **Prepare the food by precisely following your recipe.**

   Some recipes call for you to fill your jars with raw food; others may want you to precook the food. If you're precooking your low-acid food before filling your jars, don't discard the cooking liquid; use this liquid for filling your jars.

REMEMBER

Work in manageable batches. To determine just what a "manageable batch" is, consider how much food fills one canner load at a time. Most recipes are geared for manageable batches, but if you're in doubt, check the yield for the recipe.

Step 3: Filling your jars

Always place your product into hot jars (you keep them hot by leaving them in a kettle of hot water, as explained in "Step 1: Gearing up.") To fill your jars, follow these steps:

1. **Remove a jar from the kettle and pack the food into the jar so that the food is snug, yet loose enough for liquid to circulate into the open spaces.**
2. **Ladle boiling water (or the liquid from precooking the vegetables) into the jars, leaving the amount of headspace stated in your recipe.**

   TIP

   If you're adding cooking liquid, divide the cooking liquid evenly among the jars and finish filling the jars with boiling water, if necessary. That way, if you run short of the cooking liquid, you won't have one jar filled with only boiling water.

3. **Release any air bubbles with a nonmetallic spatula or a tool to free bubbles.**

   If the headspace drops, add additional food and liquid to the jar.

4. **Wipe the jar rims with a clean, damp cloth.**

   Have a few rags handy to be sure you're using a clean one every time.

5. **Place a lid on the jar (seal side down) and secure the lid in place with a screw band.**

   Hand-tighten the band without overtightening it.

REMEMBER

Always work quickly, stopping for nothing. Time is of the essence! Your hot foods need to remain hot, your lids seal best if placed on the jars while hot, and your food needs to be processed as quickly as possible to preserve the most flavor and quality.

Step 4: Placing the jars in the canner

Place your filled and closed jars carefully on the rack in the pressure canner, making sure you have the recommended amount of simmering water in the bottom of the canner. Don't crowd the jars or place more jars in the canner than is recommended for your size of pressure canner. Place them so that they're stable, won't tip, and don't touch each other or the side of the canner.

REMEMBER

If your recipe makes more jars than your canner can hold, fill only enough jars for one canner load and do the rest in the next batch. Do not fill all the jars and leave a few waiting for the next canner load.

TIP

Unlike water-bath canning, you can process a second layer of pint or half-pint jars at the same time as long as your canner accommodates the height of the two layers. To build the second layer, place a second rack on top of the first layer of jars. Stagger the second layer of jars so they aren't directly above the bottom layer. This permits proper air circulation for achieving the proper pressure and temperature. After you have a few simple canning sessions successfully under your belt, try this technique to save a little time.

Step 5: Closing and locking the canner

For optimum performance, steam must be allowed to steadily escape from the canner for a specified period. This process is called *exhaustion.* Properly closing and locking your pressure canner ensure that exhaustion can take place. Closely follow your owner's manual when closing and locking the pressure canner. (If not sealed properly, the canner won't build pressure or hot water will spit out or both.)

Step 6: Processing your filled jars

Once your canner lid is locked on, you're ready to beginning processing your filled jars. Follow these steps:

1. **Allow a steady stream of steam to escape from the pressure canner for 10 minutes or the time recommended in your manual.**
2. **Close the vent, bringing the pressure to the amount specified in your recipe.**

   If you live in higher altitudes, see the section "Pressure Canning at Higher Altitudes" for information on how to adjust the pounds of pressure used during processing.

   REMEMBER

   Processing time starts when your canner reaches the required pressure. The pressure must remain constant for the entire processing time. If your pressure drops at any time during processing, so will your temperature. To remedy this problem, return the pressure to the specified amount by increasing the heat. After your pressure has been regained, start your processing time from the beginning.
3. **After the processing time has passed, turn the heat off and allow the pressure to return to 0.**

   Allowing the pressure to return to 0 may take as long as 30 minutes. Don't disturb the canner; jars that are upset may not seal properly.

Step 7: Releasing the pressure after processing

Approximately 10 minutes after the pressure returns to 0, or at the time stated in the manual, remove the lid, opening the cover away from you and allowing the steam to flow away from you.

Don't underestimate the importance of following the instructions in your owner's manual, step by step, for releasing the pressure in the canner after your processing time is concluded. There's no quick-release method for a pressure canner as there is for a pressure cooker. Don't confuse the two!

WARNING

Running water over your pressure canner to reduce the pressure is a definite no-no. The sudden change in temperature can cause the jars to burst.

Step 8: Removing and cooling the jars

Ten minutes after you release the pressure (Step 7), remove the jars from the pressure canner with a jar lifter. Place them on a clean towel, away from drafts with 1 to 2 inches of space around the jars.

The jars may take as long as 24 hours to completely cool. Don't be tempted to play with the lids or adjust the bands.

REMEMBER

As your jars cool, you'll hear a popping noise coming from them, indicating a vacuum seal. You will soon learn to look forward to these tiny pings and dings. This canning music means you have successfully saved your summer bounty.

Step 9: Testing the seal and storing your bounty

The final pressure-canning step is to test the seals on your completely cooled jars: Push on the center of the lid. If the lid feels solid and doesn't indent, you've produced a successful seal. If the lid depresses when applying pressure, this jar isn't sealed. Refrigerate any unsealed jars immediately, using the contents within two weeks or the period stated in your recipe.

To store jars, do the following:

1. **Remove the screw bands of the sealed jars.**
2. **Remove any residue by washing the jars, lids, and bands in hot, soapy water; then dry them.**
3. **Label your jars with the content and date of processing.**
4. **Store the jars without the screw bands, in a cool, dark, dry place.**

WARNING

Although you may follow all the steps and procedures for pressure canning low-acid foods, you still have a chance for spoilage. Botulism poisoning can be fatal. Because botulism spores have no odor and can't be seen, you can't always tell which jars are tainted. If you suspect that a jar of food is spoiled, never, never, never taste it. Instead, dispose of the food responsibly.

Pressure Canning at Higher Altitudes

If you're canning at an elevation higher than 1,000 feet above sea level, adjust the pounds of pressure used during processing, according to Table 3-1. Your pressure-canner processing time will remain the same.

TIP

If you don't know your altitude level, you can get this information by contacting your public library, a local college, or the cooperative extension service in your county or state. Or go to `http://national4-hheadquarters.gov/Extension/index.html`. Click on your state on the map and follow the instructions on your state's website.

TABLE 3-1 High-Altitude Processing Times for Pressure Canning

Altitude	Process at This Pressure
2,000–3,000	11½ pounds
3,000–4,000	12 pounds
4,000–5,000	12½ pounds
5,000–6,000	13 pounds
6,000–7,000	13½ pounds
7,000–8,000	14 pounds
8,000–9,000	14½ pounds
9,000–10,000	15 pounds

Canning Vegetables

Early in the growing season, your garden produces enough each day for one or two meals, and then the explosion starts. Tomatoes, zucchini, and beans, to name a few, abound. You wonder, "How can just a few plants produce so many vegetables?" You're proud to share your bounty with friends, neighbors, and coworkers, but there's a limit to how much you can give away!

Now, reality sets in. You have to do something with this harvest or it will go to waste! It's time to get out your pressure canner, check your equipment, and get busy pressure canning. You must act quickly if you plan to preserve these vegetables for use in the winter and spring.

Picking the perfect produce

Whether harvesting your vegetables from the garden or shopping at a farmer's market or your local supermarket, select vegetables that are free of bruises and imperfections. These marks could encourage the growth of bacteria in your food. Follow this basic rule for evaluating damage on vegetables for canning: If you won't eat that portion of the vegetable, don't buy it and can it.

The key to keeping all this wonderful, perfect freshness? Process the vegetables the day of harvesting or purchasing — the sooner the better. If you need to wait a day, store the items in your refrigerator to preserve the quality and prevent deterioration of your food. Don't make your vegetables wait longer than one day!

Vegetables not recommended for pressure canning

Some vegetables shouldn't be preserved by pressure canning because the food may discolor, produce a stronger flavor when canned, or just lose its look (meaning it disintegrates or falls apart when placed under high heat and high pressure). Other methods, such as pickling (see Chapter 4 of this minibook) or freezing (see Chapter 5 of this minibook), may be better preserving choices for these foods. Table 3-2 lists some vegetables you may be tempted to pressure-can but that will preserve better in other ways.

TABLE 3-2 Vegetables Not Recommended for Pressure Canning

Vegetable	Suggested Preservation Method
Broccoli	Freezing
Brussels sprouts	Freezing
Cabbage	Pickling (to make sauerkraut)
Cauliflower	Pickling
Cucumbers	Pickling
Eggplant	Pickling
Mushrooms (For safety, use ones that are commercially grown; don't go out and pick some yourself.)	Pickling
Parsnips	Pickling
Rutabagas	Pickling
Turnips	Pickling

Cleaning your vegetables

Properly cleaning your vegetables is important to your finished. The method and amount of cleaning required is determined by where the vegetables were grown: above the ground (such as beans or squash) or in the ground (such as carrots or beets).

- **Vegetables growing above the ground:** These vegetables usually have a thinner, more tender skin than vegetables grown in the ground. Remove any stems and leaves. Run water over them, gently rub the skin with your fingers and remove any dirt. Shake off the excess water and place your food on clean kitchen or paper towels.

- **Vegetables growing in the ground:** Root vegetables, such as carrots and beets, may require soaking to loosen any clinging soil. After first rinsing the vegetables, immerse them in a basin of cool water. Using a stiff brush (a new toothbrush works well), scrub the surface of the vegetables, removing any clinging soil. Rinse thoroughly with running water, placing the vegetables on clean kitchen or paper towels to drain.

Raw packing versus hot packing

Raw packing and hot packing foods refers to the way the food is treated before it is placed in the jars. In raw packing, you don't cook the food prior to processing. In hot packing, you do. The following section goes into more details on which method is preferable when you're canning vegetables.

REMEMBER

Packing food raw or hot doesn't change your processing time. Reaching the required pressure in your canner, usually 10 pounds, takes the same amount of time, regardless of the temperature of your raw- or hot-packed jars.

Raw (cold packing)

The *raw packing* (also called cold packing) method uses raw, unheated vegetables for filling your prepared jars. Filling the jars with raw vegetables keeps them firm without being crushed during processing. Refer to your recipe instructions to decide whether to remove the skin or cut the vegetables into pieces.

Disadvantages of using raw vegetables include the following:

- **Floating food:** During the pressure-canning process, air is removed from the vegetable fiber, causing the food to shrink. With more room in the jars, the vegetables have room to float toward the top of the jar (this is called *floating food*). Floating food doesn't affect the quality of your final product, but it may be unattractive.
- **Discoloring:** *Discoloring* occurs when the food comes in contact with air in the jar, causing a color change in your food after two or three months of storage. The flavor of your product is not affected, but the change in color in a portion of the food may appear odd.

To fill your jars using a raw packing method, follow these instructions:

1. **Wash your vegetables.**
2. **Prepare the hot liquid (refer to your recipe) for filling your jars.**
3. **Fill the hot, prepared jars with your raw vegetables.**

4. **Add the hot liquid and canning salt, if required.**
5. **Release any air bubbles with a nonreactive tool (refer to Chapter 1 in this minibook).**

   If the headspace in your jar drops, add additional food and liquid to maintain the headspace stated in your recipe.
6. **Wipe the jar rims; add the two-piece caps, and process the filled jars in a pressure canner.**

Hot packing

When you *hot pack*, you precook or heat your vegetables prior to placing them in your prepared canning jars. It's the preferred method for the majority of vegetables, particularly firm ones, such as carrots and beets. Using precooked vegetables improves the shelf life of the processed food by increasing the vacuum created in the jar during the pressure-canning period.

Precooking your vegetables in a boiling liquid, usually water, preshrinks the food and makes it more pliable, which allows you to pack more food into your jars. This results in using fewer jars. The method is a simple one:

1. **Wash your vegetables.**
2. **Heat your liquid to a boil in a large pot and add the vegetables, precooking them as directed in your recipe.**
3. **Immediately fill your prepared jars with the hot vegetables, followed with the hot cooking liquid.**
4. **Release any air bubbles with a nonreactive tool.**

   If the headspace in your jar drops, add additional food and liquid to maintain the headspace stated in your recipe.
5. **Wipe the jar rims, add the two-piece caps, and process the filled jars in a pressure canner.**

Vegetable Canning Recipes

This section offers instructions and guidelines for pressure canning some of the more common fresh vegetables. Included are tips for selecting your vegetables, determining the approximate amounts of fresh vegetables for yielding 1 quart of a finished product, and which method is preferred.

Asparagus

Select firm, bright-green stalks with tightly closed tips. Stalks with small diameters indicate a young, tender vegetable. Cut stalks into 1-inch pieces or can them whole, placing the tips of the stalks toward the top of the jar (be sure to trim them from the bottom to maintain the headspace indicated in the recipe).

Canning asparagus is a great way to preserve this delicate vegetable. With only one short season, it is usually a special treat or pricy delicacy during the rest of the year. Keeping plenty on hand will ensure that your family can enjoy this treat any time it wants. In Chapter 4 of this minibook, you can find a recipe for Pickled Asparagus.

Beans

When you can green, string, Italian, or wax beans, select ones that are tender and small. Remove the ends and strings from the beans, as shown in Figure 3-8. Can them whole or cut them into 1- to 2-inch pieces.

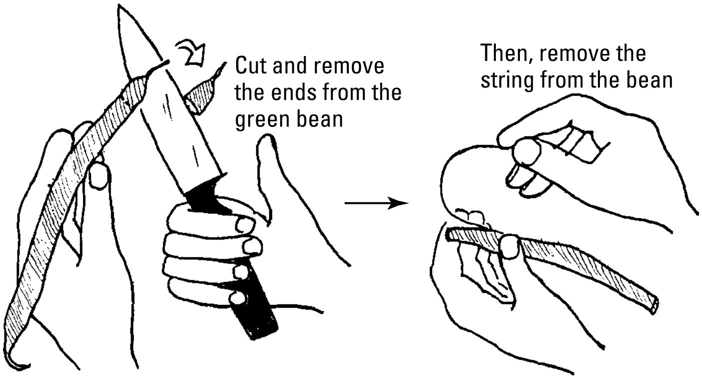


FIGURE 3-8: Removing the ends and strings from green beans.

Beets

Select beets with a deep red color. A beet with a diameter of 1 to 2 inches is the most desirable size for pressure canning. Larger-size beets are best pickled (head to Chapter 4 of this minibook for information on pickling and a Spiced Pickled Beets recipe). Figure 3-9 details how to prepare a beet.

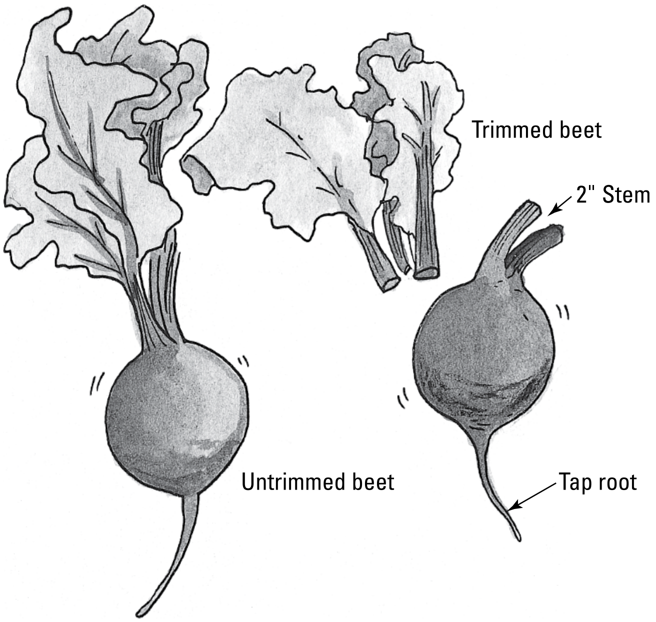


FIGURE 3-9: A trimmed beet ready for precooking.

Bell peppers (green, red, orange, yellow)

Sweet, firm bell peppers produce the best results. With so many beautiful colored peppers available, a jar of canned bell peppers could turn into a lovely gift.

REMEMBER

Because of the extremely low acid level in this vegetable, you must adjust the acidity level of the bell peppers by adding bottled lemon juice. Use only pint or half-pint jars for this extremely low-acid vegetable.

To peel peppers easily, heat them in a 400-degree oven for 6 to 8 minutes, or until the skin blisters. Then cover them with a damp cloth and let them cool. Voilà! You can now easily remove skins with a knife or simply by rubbing them with your hands as you run cool water over the pepper.

Carrots

For canning, choose carrots with a diameter of 1 to 1½ inches. Canned carrots make a favorite side dish even faster. Once reheated, add brown sugar and butter for a sweet treat.

Carrots are an inexpensive vegetable at farmer’s markets during their season, and canning is an excellent way to preserve them. They keep all of their sweet flavor and the texture remains very nice.

Corn

Starting with corn that has the husks on and the silk attached allows you to assess the freshness of the corn. Choose ears with brightly colored husks that are free of spots and moisture; silks should be golden, not matted or brown.

Creamed corn doesn't contain cream. Its creaminess comes from the naturally sweet juice, or *milk*, of the kernel. To obtain the creaminess, simply cut off the kernels and run your knife against the cob a second time, even closer to release the milk. Creamed corn is a great base for soups and makes a classic comfort food.

TIP

Here's a surefire way to select corn that is sure to be juicy and tender: Peel back the husk slightly to check for any pests. If all is clear (no bugs or mold), use your thumbnail to depress a kernel about an inch below the top of the corn. If the ear has adequate moisture, liquid will squirt out. Buy this ear! If no spitting occurs, select another ear and repeat the test.

Onions

Onions are a staple ingredient in many recipes. Their savory flavor often is the finishing touch to your favorite meal. Canning onions leave them soft but flavorful. Keep these onions in your pantry as an important ingredient for your favorite recipe.

Peas

There is nothing like the taste of garden fresh peas. If your kids have decided they don't like cooked peas, convince them that your own canned peas are worth a try.

Potatoes

The only potatoes recommended for pressure canning are sweet potatoes, yams, and white, or Irish, potatoes. Using any other potatoes yields inferior results because of their chemical makeup (texture and composition).

- **White or Irish:** These potatoes are round and white with a thin skin. Peel the potatoes prior to precooking. Small potatoes (2 to 3 inches in diameter) may be left whole; cut larger potatoes into quarters before precooking.
- **Sweet potatoes and yams:** Sweet potatoes are roots and yams are tubers — so they're actually from two different plant species. Even though sweet potatoes and yams are unrelated, they're suitable for the same uses. Sweet potatoes have skin colors ranging from light yellow to dark orange and flesh colors ranging from pale yellow to medium orange and are sweeter than

yams. Yams contain more natural sugar and have a higher moisture content than sweet potatoes; they're white to deep red in flesh color with skin colors ranging from creamy white to deep red. Small potatoes may be left whole; cut larger ones into quarters before removing the skins.

Try draining canned potatoes to use in homemade hash in the winter. They are hearty breakfast fare after a cold morning on the homestead.

Sweet potatoes can complement a meal with their rich, naturally sweet flavor. The bright orange color makes a dish pop, and many who think they don't like any veggies are pleasantly surprised at the delicious taste of the sweet potato. The recipe in this chapter produces a firmer finished product with much more flavor — a definite improvement over store-bought sweet potatoes from a can.

Summer squash

Summer squash include crookneck, zucchini, and patty pan, to name a few. The skins are thin and edible, eliminating the need to peel them.

Canned Asparagus

PREP: 15 MIN	PROCESSING: PINTS, 30 MIN; QUARTS, 40 MIN	PRESSURE: 10 POUNDS	YIELD: 14 PINTS OR 7 QUARTS

INGREDIENTS

24 pounds fresh, young asparagus

Boiling water

Canning salt

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For detailed instructions on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Wash the asparagus spears. Cut them into 1-inch pieces. In a 12-quart pot, bring water to a boil. Heat the asparagus pieces in the boiling water for 2 to 3 minutes, until the spears are bright green but still firm inside. Do not drain.

3 Loosely pack the cut spears into jars (don't press them down). Pour the boiling cooking liquid over the pieces, leaving 1-inch headspace. Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Release any air bubbles with a nonreactive utensil, adding more liquid as necessary to maintain the proper headspace (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a pressure canner at 10 pounds pressure for 30 minutes (pints) or 40 minutes (quarts). When the processing time is done, allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

5 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Before eating or tasting, boil the food for 15 minutes.

PER ½-CUP SERVING: *Calories 23 (From fat 3); Fat 0g (Saturated0); Cholesterol 0mg; Sodium 301mg; Carbohydrates 4g (Dietary fiber 2g); Protein 3g*

Canned Fresh Green Beans

PREP: 15 MIN	PROCESSING: PINTS, 20 MIN; QUARTS, 25 MIN	PRESSURE: 10 POUNDS	YIELD: 16 PINTS OR 8 QUARTS

INGREDIENTS

4 pounds fresh green beans

Boiling water

Canning salt

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2. In an 8-quart pot, bring 2 quarts of water to a boil. While water is boiling, trim off the ends of the beans and cut them into 2-inch pieces.

3. Tightly pack the cut beans into the prepared jars. Pour the boiling water over the beans, leaving 1-inch headspace. Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Release any air bubbles with a nonreactive utensil, adding more water as necessary to maintain the proper headspace (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4. Process the filled jars in a pressure canner at 10 pounds pressure for 20 minutes (pints) or 25 minutes (quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

5. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 15 minutes.

PER ½-CUP SERVING: *Calories 10 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 292mg; Carbohydrates 2g (Dietary fiber 1g); Protein 1g*

Canned Beets

PREP: 15 MIN	PROCESSING: PINTS, 30 MIN; QUARTS, 35 MIN	PRESSURE: 10 POUNDS	YIELD: 14 PINTS OR 7 QUARTS

INGREDIENTS

21 pounds beets without tops

Canning salt

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Scrub your beets clean of dirt and remove the tap roots (see Figure 3-9). Place the cleaned beets in a 12-quart pot and cover them with water. Boil the beets for 15 to 20 minutes. When beets are cool enough to handle, the skins will peel off easily. Remove them from the water and peel. Trim the remaining root and stem. Leave small beets whole, and cut larger beets in half for a better fit in the jar. Reserve the cooking liquid.

3 Pack the beets into your prepared jars. Pour the cooking liquid over the beets, leaving 1-inch headspace. Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Release any air bubbles with a nonreactive utensil, adding more liquid as necessary to maintain the proper headspace (see Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a pressure canner at 10 pounds pressure for 30 minutes (pints) or 35 minutes (quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

(continued)

5. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 15 minutes.

NOTE: To preserve the bright, red color of the beet, add 1 tablespoon of vinegar (with an acidity of 5 percent) to each quart of liquid before sealing the jars.

PER ½-CUP SERVING: *Calories 72 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 416mg; Carbohydrates 0g (Dietary fiber 0g); Protein 0g*

Canned Bell Peppers

PREP: 15 MIN	PROCESSING: HALF-PINTS, 35 MIN; PINTS, 40 MIN	PRESSURE: 10 POUNDS	YIELD: 10 HALF-PINTS OR 5 PINTS

INGREDIENTS

5 pounds sweet peppers

Boiling water

Canning salt

Lemon juice

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Wash the peppers and cut them into quarters and remove the stem and seeds. Meanwhile bring 2 quarts of water to a boil.

3 Pack flattened peppers firmly into jars. Pour the boiling water over the peppers, leaving 1-inch headspace. Add ½ tablespoon lemon juice and ¼ teaspoon salt to each half-pint jar or 1 tablespoon lemon juice and ½ teaspoon salt to each pint jar. Release any air bubbles with a nonreactive utensil, adding more water as necessary to maintain the proper headspace (see Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a pressure canner at 10 pounds pressure for 35 minutes (half-pints) or 40 minutes (pints). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

5 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Before eating or tasting, boil the food for 15 minutes.

PER ½-CUP SERVING: *Calories 32 (From fat 2); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 584mg; Carbohydrates 8g (Dietary fiber 2g); Protein 1g*

Canned Carrots

PREP: 15 MIN	PROCESSING: PINTS, 25 MIN; QUARTS, 35 MIN	PRESSURE: 10 POUNDS	YIELD: 6 PINTS OR 3 QUARTS

INGREDIENTS

12 pounds of carrots, peeled and without tops

Canning salt

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2. Rinse and scrub the carrots with a brush to remove any dirt. Alternatively, remove the skin with a vegetable peeler. Remove the carrot tops. Cut the carrots into ¼-inch slices or dice the carrots, being sure that all the diced pieces are approximately the same size.

3. Place the sliced or diced carrots in a 12-quart pot and cover them with water. Bring them to a boil. Reduce heat to medium and allow the carrots to simmer for 5 minutes, or until they're still slightly firm in the center but tender on the outside. Do not drain.

4. Pack the hot carrots into your prepared jars. Pour the cooking liquid over them, leaving 1-inch headspace. Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Release any air bubbles with a nonreactive utensil, adding more liquid as necessary to maintain the proper headspace (see Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5. Process the filled jars in a pressure canner at 10 pounds pressure for 25 minutes (pints) or 35 minutes (quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

6 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 10 minutes.

PER ½-CUP SERVING: *Calories 94 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 424mg; Carbohydrates 22g (Dietary fiber 7g); Protein 2g*

Canned Corn

PREP: 15 MIN	PROCESSING: PINTS, 55 MIN; QUARTS, 85 MIN	PRESSURE: 10 POUNDS	YIELD: 12 PINTS OR 6 QUARTS

INGREDIENTS

24 pounds fresh corn on the cob

Boiling water

Canning salt

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Remove the husk and silk from the corn. Using a sharp knife, slice the corn from the cob, measuring the corn as you go so that you know how many total pints or quarts of corn kernels you have. Meanwhile, bring 1 gallon of water to a boil in an 8-quart pot (you'll use this as a reserve).

3 Place the corn in a 12-quart pot. For each pint of corn, add 1 cup of boiling water; for each quart of corn, add 2 cups of boiling water. Place the pot over medium-high heat and bring to a simmer. Then reduce heat to medium and allow the corn to simmer for 5 minutes.

4 Ladle the corn into your prepared jars and pour additional boiling water over it if necessary, leaving 1-inch headspace. Add 1 teaspoon salt to each quart jar or ½ teaspoon salt to each pint jar. Release any air bubbles with a nonreactive utensil, adding more water as necessary to maintain the proper headspace (see Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5 Process the filled jars in a pressure canner at 10 pounds pressure for 55 minutes (pints) or 1 hour 25 minutes (quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

6. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 15 minutes.

PER ½-UP SERVING: *Calories 136 (From fat 15); Fat 2g (Saturated 0g); Cholesterol 0mg; Sodium 312mg; Carbohydrates 32g (Dietary fiber 3g); Protein 4g*

Canned Creamed Corn

PREP: 20 MIN	PROCESSING: PINTS, 95 MIN	PRESSURE: 10 POUNDS	YIELD: 9 PINTS

INGREDIENTS

20 pounds corn

Boiling water

Canning salt

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 In a 12-quart pot, bring 2 gallons of water to a boil. Remove the husk and silk from the corn. Blanch the corn on the cob for 4 minutes in the boiling water. Allow the corn to cool enough to handle. Slice the corn kernels from cob with a sharp knife. Then run the knife blade along the ear again to remove the extra juice or milk. Measure the corn as you go so that you know how many pints of corn and corn milk you have.

3 Place the corn and corn milk in a 12-quart pot. For each pint of corn and corn milk, add 2 cups of water. Heat the corn to boiling.

4 Using a canning funnel, pour the corn and corn milk mixture into your prepared jars, leaving 1-inch headspace. Add ½ teaspoon salt to each jar. If necessary to attain the required headspace, add boiling water to the jars. Release any air bubbles with a nonreactive utensil, adding more water as necessary to maintain the proper headspace (see Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5 Process the filled pint jars in a pressure canner at 10 pounds pressure for 1 hour 35 minutes. Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

6. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel or paper towels away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven’t sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 10 minutes.

NOTE: This recipe uses pints (quarts aren’t recommended).

PER ½-CUP SERVING: *Calories 151 (From fat 16); Fat 2g (Saturated 0g); Cholesterol 0mg; Sodium 605mg; Carbohydrates 35g (Dietary fiber 4g); Protein 5g*

Canned Onions

PREP: 20 MIN
PROCESSING: PINTS AND QUARTS, 40 MIN
PRESSURE: 10 POUNDS
YIELD: 20 PINTS OR 10 QUARTS

INGREDIENTS

20 pounds fresh onions
Canning salt

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Peel and wash the onions. If you're using large onions, chop them or slice them into ½-inch pieces.

3 Place the onions in a 12-quart pot, cover them with water, and bring them to a boil over medium high heat. Boil them for 5 minutes, or until they're translucent.

4 Using a slotted spoon, remove the onions from cooking liquid (reserve the liquid for filling the jars) and firmly pack them into the prepared jars. Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Pour the hot cooking liquid over the onions, leaving 1-inch headspace. Release any air bubbles with a nonreactive utensil, adding liquid as necessary to maintain the proper headspace (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5 Process the filled jars in a pressure canner at 10 pounds pressure for 40 minutes (pints or quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid away.

6. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Before eating or tasting, boil the food for 15 minutes.

PER ½-CUP SERVING: *Calories 42 (From fat 2); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 294mg; Carbohydrates 10g (Dietary fiber 1g); Protein 1g*

Canned Peas

PREP: 15 MIN	PROCESSING: PINTS AND QUARTS, 40 MIN	PRESSURE: 10 POUNDS	YIELD: 14 PINTS OR 7 QUARTS

INGREDIENTS

28 to 30 pounds fresh, young peas in the pod

Canning salt

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 Wash and remove the pods. Place the peas in an 8-quart pot, cover them with water, and bring to a boil over high heat. Allow the peas to boil for 3 to 5 minutes, or until they're bright green but not fully cooked.

3 Remove the peas from the cooking liquid (reserve the liquid for filling jars) and loosely pack the peas into the prepared jars. Pour hot cooking water over them, leaving 1-inch headspace Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Release any air bubbles with a nonreactive utensil, adding liquid as necessary to maintain the proper headspace (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a pressure canner at 10 pounds pressure for 40 minutes (pints or quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

5 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Before eating or tasting, boil the food for 15 minutes.

PER ½-CUP SERVING: *Calories 70 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 295mg; Carbohydrates 13g (Dietary fiber 4g); Protein 5g*

Canned White Potatoes

PREP: 15 MIN	PROCESSING: PINTS, 35 MIN; QUARTS, 40 MIN	PRESSURE: 10 POUNDS	YIELD: 14 PINTS OR 7 QUARTS

INGREDIENTS

7 pounds fresh, young potatoes

Canning salt

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2. In a 12-quart pot, bring 2 gallons of water to boil. Wash and peel your potatoes. Cube the potatoes into ½-inch pieces. Carefully place the potatoes in the boiling water and cook for 2 minutes or until potatoes are partially cooked but still firm.

3. Pack the hot potatoes into the prepared jars (reserve the liquid you cooked them in). Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Pour the cooking liquid over the potatoes, leaving 1-inch headspace. Release any air bubbles with a nonreactive utensil, adding liquid as necessary to maintain the proper headspace (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4. Process the filled jars in a pressure canner at 10 pounds pressure for 35 minutes (pints) or 40 minutes (quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

5. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 15 minutes.

PER ½-CUP SERVING: *Calories 36 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 292mg; Carbohydrates 7g (Dietary fiber 1g); Protein 1g*

Canned Sweet Potatoes

PREP: 15 MIN

PROCESSING: PINTS, 65 MIN; QUARTS, 90 MIN

PRESSURE: 10 POUNDS

YIELD: 14 PINTS OR 7 QUARTS

INGREDIENTS

21 pounds sweet potatoes

Canning salt

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2. In a 12-quart pot, bring 2 gallons of water to boil. Wash and peel the sweet potatoes. Cube them into ½-inch pieces. Carefully place the sweet potatoes into the boiling water and cook for 10 minutes, or until the potatoes are partially cooked but still firm. Reserve the cooking liquid.

3. Pack the hot sweet potatoes into the prepared jars. Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Pour the cooking liquid over the sweet potatoes, leaving 1-inch headspace. Release any air bubbles with a non-reactive utensil, adding liquid as necessary to maintain the proper headspace (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4. Process the filled jars in a pressure canner at 10 pounds pressure for 1 hour 5 minutes (pints) or 1 hour 30 minutes (quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

5. Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 15 minutes.

PER ½-CUP SERVING: *Calories 139 (From fat 4); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 308mg; Carbohydrates 32g (Dietary fiber 2g); Protein 2g*

Canned Summer Squash

PREP: 15 MIN	PROCESSING: PINTS, 30 MIN; QUARTS, 40 MIN	PRESSURE: 10 POUNDS	YIELD: 14 PINTS OR 7 QUARTS

INGREDIENTS

8 to 20 pounds summer squash

Canning salt

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see the step-by-step directions earlier in this chapter.)

2 In a 12-quart pot, bring 2 gallons of water to boil. Wash and cut the summer squash into ¼-inch slices or 1-inch cubes. Carefully place the cubed or sliced squash into your boiling water and return to a boil for 5 minutes, or until slightly softened. Reserve the cooking liquid.

3 Using a canning funnel, loosely pack the squash into the prepared jars. Pour the hot cooking liquid over the squash, leaving ½-inch headspace. Add ½ teaspoon salt to each pint jar or 1 teaspoon salt to each quart jar. Release any air bubbles with a nonreactive utensil, adding liquid as necessary to maintain the proper headspace (refer to Chapter 1 of this minibook). Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a pressure canner at 10 pounds pressure for 30 minutes (pints) or 40 minutes (quarts). Allow the pressure to return to 0, wait an additional 10 minutes, and then carefully open the canner lid.

5 Remove the jars from the canner with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (refer to the step-by-step directions earlier in this chapter). If you find jars that haven't sealed, refrigerate them and use them within two weeks. Prior to eating or tasting, boil the food for 10 minutes.

PER ½-CUP SERVING: *Calories 28 (From Fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 294mg; Carbohydrate 6g (Dietary Fiber 3g); Protein 2g*

IN THIS CHAPTER

- **Investigating the ingredients of a perfect pickle**
- **Adding crunch to your own homemade pickles and other pickled vegetables**

Chapter 4

Pickling

Pickling is used for a wide range of foods, including fruits and vegetables. Although pickling isn't practiced much today, don't overlook this rewarding process.

This chapter gives you an overview of pickling, describing the ingredients, the utensils, and the methods used. In no time, you'll be making easy-to- prepare pickled food and condiments that will wow your taste buds and let you enjoy that bumper crop of cukes (and other veggies) all year long.

Perusing Pickling Ingredients

Pickling preserves food in a *brine solution,* a strong mixture of water, salt, vinegar, and sometimes sugar or another sweetener, such as corn syrup. Brining is what gives the vegetables the pickled texture and flavor you're going for.

Some recipes (usually older ones) include a brining step before the actual canning. Other pickling recipes add the brine solution to the raw vegetable and the brining happens in the sterile canning jar as it sits on your shelf. These recipes generally have a recommendation for how many weeks to wait for best flavor.

The four basic ingredients for pickling are salt, vinegar, water, and herbs and spices. Use high-quality ingredients for the best results.

REMEMBER

The perfect balance of salt, vinegar, water, and herbs and spices safely preserves your pickled food. You can achieve this balance by precisely measuring your ingredients and following each step in your recipe.

Salt

Salt is used as a preservative. It adds flavor and crispness to your food, especially pickles. Use a pure, additive-free, granulated salt. Acceptable salts are *pickling and canning salt* (a fine-grained salt containing no additives), most kosher salt, and *sea salt,* salt produced from evaporated seawater.

TIP

Not all kosher salts are the same. The two most popular brands, Diamond and Morton, are quite different in many respects, including (believe it or not) their saltiness! Add the same measurement of each brand to two recipes that are otherwise identical; the difference will not only astound you, it can even ruin some pickling recipes. Without getting into the technical nuts and bolts of how each company makes their salt (which accounts for the disparity), the part you need to know is this: Morton's kosher salt tastes almost twice as salty as Diamond's product. When using Morton kosher salt in recipes, it is suggested that you use the prescribed amount, knowing you may need to add a pinch more than the table or pickling salt measurement. If you have Diamond kosher salt on hand, double the prescribed amount to keep the finished flavor in check.

REMEMBER

Additives in salt cause cloudy liquid. Always read the ingredient label on your salt container to ensure it's additive-free. Salts *not* suitable for brining and pickling solutions are

- **Table salt and iodized salt:** These contain *anti-caking agents,* additives that keep the salt from sticking together. These cloud your liquid. Iodine darkens food.
- **Rock salt:** Rock salt keeps roads free of ice and isn't made for use with food. It's okay in an ice-cream freezer because it never touches the food.
- **Salt substitutes:** These products contain little or no sodium.

Vinegar

Vinegar is a tart liquid that prevents the growth of bacteria. For pickling, you must use a vinegar with an acidity level of 5 percent. If the level of acidity isn't on the label, don't use the vinegar — the strength of the acid may not be adequate for safe food preservation.

The preferred vinegar for pickling is distilled white vinegar, which has a sharp, tart flavor, maintains the color of your food, and is relatively inexpensive. For a milder flavor, you can substitute apple cider vinegar. Keep in mind, though, that using cider vinegar will change the overall color of your finished foods, not always for the better. You may get unappetizing gray or brown results from using the wrong type of vinegar.

To avoid cloudy pickles, use a vinegar that's clear from sediment. Cider and wine vinegars often have sediment, and you may even be able to see things floating around. What causes the sediment? Vinegars that still contain the *mother,* a harmless bacterium that creates the vinegar but also causes sediment to form on the bottom of the bottle.

WARNING

Never dilute or reduce the amount of vinegar in a recipe. To ensure a safe product, the brine must have the right acidity level. Never use a vinegar with less than 5 percent acidity.

TIP

If the flavor's too tart, add ¼ cup granulated sugar for every 4 cups of vinegar. Treating flavors in this manner won't upset the balance of your vinegar. If you don't like the flavor when you make the recipe, try another recipe. Don't forget to jot down your changes on your recipe card!

Water

Soft water is the best water for your brine solution. Too much iron in your water can cause discoloration of the finished product. *Distilled water,* water with all minerals and other impurities removed, is also a good choice. If you use tap water, make sure it's of drinking quality; if it doesn't taste good to you, it won't taste better in your food. Also, avoid using sparkling water.

Herbs and spices

Use the exact amount of herbs or spices called for in your recipe. If your recipe calls for a fresh herb, use the fresh herb. If your recipe calls for a dried spice, use one with a strong aroma. (For more information on drying herbs and spices, check out Chapter 6 of this minibook.)

Pickling spices are blends of many spices including allspice, bay leaves, cardamom, cinnamon, cloves, coriander, ginger, mustard seed, and peppercorns. They're mixed by the manufacturer and vary in flavor. Although these spices are generally whole and therefore good keepers, it is best to buy fresh, new spices each year, before you start canning.

Brining Education

The brining process is a key part of the pickling process because it does these important things:

- Chemically, it draws out the natural juices and replaces them with salty/vinegar solution, giving your veggies that familiar pickled flavor and texture.
- It extracts juice and sugar from your food, forming *lactic acid,* a bitter-tasting tart acid. This lactic acid serves as the preservative in your pickled food.
- Because the brining solution typically includes vinegar (an acid), it safely converts your low-acid foods (those with a pH level over 4.6) to high-acid foods (with a pH level of 4.6 or less), making it safe for water-bath canning. (This is why you must prepare your recipe as it's written and *not* modify the amounts.)

As mentioned previously, sometimes you brine your vegetables before canning; other times, you add the brine solution to the raw vegetables and let the brining occur in the canning jar. The following sections explain how to prepare your veggies for each.

Fresh (or raw) packing: Adding brine to the raw veggies

In this method, you place fresh raw vegetables in prepared jars and then cover them with hot flavored liquid, usually a spicy vinegar, and process the filled jars in your water-bath canner. To ensure the pickling process can occur uniformly, make sure your vegetables are completely submerged in the brining solution. Most of the recipes in this chapter require raw packing.

Complete precooking

In this method, you cook your food completely before filling your jars. The following relish recipe is precooked before canning. The taste of the relish is present before you add it to the jars, and it's ready to eat once it is cooked.

Brining before canning

When brining your vegetables beforehand, how long you let your vegetables soak can vary anywhere from a few hours to several weeks. Your recipe provides the details. Here's what you need to know about these long or short brines:

- **Long brine:** This process is primarily used for making pickles from cucumbers. The veggies stay in the brine anywhere from five days to six weeks. The brine solution is quite heavy with salt and may contain some vinegar and spices. None of the recipes in this chapter require a long brine.
- **Short brine:** The soaking period for this method is 24 hours or less. Follow your recipe for the correct proportions in your brine solution. You use a short brine for the Sweet Pickle Relish and Zucchini Bread and Butter Pickles.

In both cases, you submerge the food in the brine solution, where it *ferments* (stays in the solution) for the recommended period of time. (Your recipe gives you the details.) After fermenting, follow your recipe and make a fresh brine solution for filling your jars. (And for much more on fermenting, see Book 3, Chapter 2.)

PICKLING VERSUS FERMENTING

Pickles are generally associated with the traditional cucumber in brine, but you can pickle all kinds of things, from fruit and vegetables to meat, fish, and eggs. In India, some of the most popular pickles are made from mango and lime. In Europe, you'll find pickled herring, olives, and beets. From Asia to Europe, the world of pickling is vast and varied.

Pickling is the process of preserving food using a brine (saltwater) solution. The salt in pickling acts on the food by drawing out the water from its cells and kills any bad bacteria that may spoil the food. Pickles are often added to a meal to help aid with digestion, giving your body that extra bit of *Lactobacillus acidophilus* it needs to restore some healthy gut and intestinal flora.

So, what's the difference between pickling and fermenting? Fermenting and pickling can seem very similar, but they're not the same thing. The process that occurs inside the brine is called fermentation, but the act of making brine and placing food into the saltwater solution is called pickling. Pickling also usually requires added heat through a canning process, whereas fermented goods can sit out on your shelf and don't require heat. Fermented foods thrive in anaerobic conditions and make use of naturally occurring "good" bacteria submerged under the saltwater. Fermented foods have a bit of a tangy flavor, while pickled goods taste salty or vinegary all the way through.

The role of salt in fermentation is to help draw out water from foods and make a salty living environment so bad bacteria have little chance of survival. A brine is created in fermented recipes to preserve fruits and vegetables or other food products. Making brine can be a bit of an experiment, and the salt measurements sometimes depend on your personal preference. Remember that a little salt goes a long way! Some brine even contains a bit of sugar to balance out the salty flavor.

TIP

Be sure to keep your food completely submerged in the brine solution, whether it's for a few hours or longer. To do this, place a sealed, water-filled glass jar on top of your food. The jar applies pressure to keep the foods submerged when you cover your brining container.

Stoneware crocks are excellent choices for brining food. You can find them at specialty cookware stores or where canning supplies are sold. But there's an important caveat: Don't use a crock that you've gotten from a thrift store or other secondhand store. Without the original packaging, you have no way of knowing whether it's lead-free and suitable for brining.

TIP

Old-time canning recipes may instruct you to "soak your pickles in salt brine strong enough to float an egg." This equates to a 10-percent brine mixture of 1 pound (about 1½ cups) of salt dissolved in 1 gallon of water.

Adding Crunch to Your Food

The best method for maintaining crispness, crunch, and firmness in your vegetables during the soaking period is to add ice, preferably crushed ice, to your soaking solution. This works best for short brine soaking.

After the soaking period, drain your vegetables in a colander, following your recipe instructions for any rinsing. Some recipes instruct you to roll the drained food in clean kitchen towels to dry it. This works well for larger pieces of food (it isn't for finely chopped relishes).

Note: In older pickling recipes, you may see the addition of alum or pickling (slaked) lime. The recipes in this chapter don't add either of these products because they aren't necessary when you're using modern canning methods.

TIP

For the best tasting pickles, follow these four tips:

- Pick produce that is blemish free and pickle your produce within 24 hours of harvesting. Never use vegetables that you have to trim off spoiled or moldy parts.
- To ensure that every piece is pickled at the same time, always pack your jars with uniformly sized vegetables.
- Scrub the vegetables well to get rid of any dirt, which contains bacteria, and trim ⅛ inch from the blossom and stem ends of cucumbers. These ends may have enzymes that will spoil or soften your pickles.
- Pack your jars tightly. Because pickling causes vegetables to shrink slightly, having them tightly filled helps prevent them from floating.

Pickling Equipment and Utensils

In addition to the basic equipment for water-bath canning (refer to Chapter 2 of this minibook), you need nonreactive utensils and equipment for handling, cooking, and brining your food. *Nonreactive* items are made of stainless steel, nonstick-surfaced items (without a damaged nonstick surface), enamelware, or glass.

WARNING

Don't use enamelware with chips or cracks or equipment or utensils made from or containing copper, iron, or brass. These items react with the acids and salt during the pickling process, altering the color of your food and giving the finished product a bad taste. *Definitely* don't use galvanized products, which contain zinc. These produce a poison when the acid and the salt touch the zinc, which is transferred to your food causing serious illness (or worse).

Pickled Vegetable Recipes

Many homesteaders start out making a basic batch of homemade pickles. But few homesteaders stop there. That's because once you see how simple pickling is, you'll no doubt want to try your hand at pickling all sorts of vegetables (and even other foods such as eggs, meats, and fruits).

The following sections will help get you started in pickling with some basic and versatile recipes.

Pickled toppers

Relish is a staple in many kitchens. Use this pickled treat anytime you'd use a relish, on a hamburger or hot dog, in tuna salad, or anytime you want to add flavor to a sandwich.

One advantage of homemade relish is mixing flavors you don't find in commercially produced relishes. Make more than you believe your family will consume in a year because this relish has a way of disappearing. Try it in homemade Thousand Island dressing.

Pickles

So what's so important about what kind of cucumber you use for pickles? After all, a cucumber is a cucumber, right? This is definitely not the case. The common salad cucumber has a thick, dark-green, waxy skin. Don't use this cucumber for making pickles because the brine solution won't penetrate the waxy coating. Use this cucumber when your recipe doesn't specify "pickling cucumbers."

REMEMBER

A pickling cucumber is the only cucumber to use for making pickles. The skin of a pickling cucumber is thin, not waxy, and is left on the cucumber. Pickling cucumbers are about 4 inches in length, smaller than salad cucumbers. Don't eat pickling cucumbers raw; their flavor can be extremely bitter. Some varieties are now sold for both pickling and slicing. These are fine to use. For pickling, use the smaller size of this variety; for slicing, use the larger size. Always look for cucumbers that are recommended for pickling, such as Kirby or Boston Pickling.

The Speedy Dill Pickles recipe in this chapter makes an old-fashioned dill pickle in almost the blink of an eye. It's an excellent confidence-builder for the beginning canner. Try it!

The Zucchini Bread and Butter Pickles recipe is the perfect solution when you're overrun with zucchini. Pick your vegetables when they are cucumber sized, and use that day for the best texture. As a bonus, these pickles are ready to eat as soon as they cool.

Pickled vegetables

Pickled vegetables are delicious additions to green salads or a relish plate. Enjoy these treats for a change of pace from plain, raw vegetables. They still retain their crisp texture, but with an extra added bite from the brine.

WARNING

Avoid long boiling periods for your vinegar solution. Lengthy boiling reduces the acetic-acid level in vinegar, changing the pH level of the food. This change may compromise the safety of your pickled food.

Asparagus

Asparagus is one of those foods that you either wish for or have too much of. Pickling the young asparagus spears provides a great way to add a new dimension to this early spring vegetable. Put these up in pints, as part of their charm is the look of the straight spears packed like soldiers inside.

Beans

Serve the beans from the Dilly Beans recipe in a Bloody Mary in place of a piece of celery. For a variation, use a combination of green and yellow string beans.

Beets

Use beets that are small and tender, not larger than 2 inches in diameter. Purchase beets with the top leaves attached. If the leaves are wilted and quite dark, the beets aren't fresh; continue your search for fresher beets. Once canned, beets are ready for eating.

Brussels sprouts

Brussels sprouts are an unusual treat when pickled and canned. In fact, you can eat them as a condiment.

TROUBLESHOOTING PICKLE PROBLEMS

Occasionally, pickling cucumbers develop hollow interiors as they grow or if they wait too long between harvesting and pickling. You can't fix hollow pickles, but you can identify them because they float when they're put in a sink of water. (Don't throw out the hollow pickles; use them for making relish.)

If your pickles are shriveled, too much salt, sugar, or vinegar was added at once to the cucumbers. Start with a weaker solution and gradually add the full amount of ingredients called for in your recipe.

Discolored pickles may be from using hard water with minerals in it. Use soft water for your brine solution as well as for the liquid for filling your jars. Reactive metals such as brass, iron, copper, aluminum, or zinc in pots and utensils cause darkening as well. Use nonreactive equipment such as enamelware with no chips or cracks, glass, stainless steel, or stoneware. Finally, your pickles may have absorbed ground spices. Prevent this by using whole spices rather than ground ones. These problems don't indicate spoilage, but your pickle flavor may be altered slightly.

Mushy or slippery pickles indicate spoilage. Discard the pickles without tasting them. Prevent these problems by accurately measuring your salt, using a vinegar with 5 percent acidity, and completely covering your pickles with liquid during the brining process and in your filled jars.

Remove the scum from your brining solution daily, use a modern-day recipe, follow your recipe to the letter, and use a heating period long enough to destroy any microorganisms.

Soft pickles in a jar with white sediment indicate spoilage. Don't taste these; simply discard them. But if the pickles are firm, they're safe to eat. The sediment is a harmless lactic acid or yeast that develops in the jar and settles to the bottom.

Sweet Pickle Relish

PREP: 55 MIN	SOAKING: 2 HR	PROCESSING: 10 MIN	YIELD: 7 HALF-PINTS OR 3 PINTS

INGREDIENTS

5 to 6 medium cucumbers

3 to 4 green and/or red bell peppers

3 to 4 medium onions

¼ cup kosher or pickling salt

Cold water, about 4 to 6 quarts

3 cups granulated sugar

2 cups cider vinegar

2½ teaspoons celery seeds

2½ teaspoons mustard seed

½ teaspoon turmeric

1. Peel the cucumbers, cut them in half lengthwise, and remove the seeds (see Figure 4-1). Finely chop the cucumbers in a food processor fitted with a metal blade, to measure 6 cups. Remove the stems and seeds from the bell peppers. Finely chop them in a food processor fitted with a metal blade, to measure 3 cups. Remove the skin of the onions. Finely chop them in a food processor fitted with a metal blade, to measure 3 cups.

2. Combine the vegetables in a 5- to 6-quart bowl. Sprinkle them with salt and add cold water to cover them. Cover the bowl; let the veggies stand at room temperature for 2 hours. Rinse the vegetables with running water in batches in a colander. Drain well.

3. Combine the sugar, vinegar, celery seeds, mustard seeds, and turmeric in a 5- to 6-quart pot. Bring the liquid to a boil over high heat, stirring occasionally to dissolve the sugar. Add the drained vegetables and return the mixture to a boil. Reduce the heat to medium-high and simmer, uncovered, stirring occasionally, for 20 to 30 minutes or until most of the excess liquid has evaporated.

4. While your relish is cooking, prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see Chapter 1 of this minibook.)

5. Spoon and lightly compact the hot relish into the prepared jars. Release any air bubbles with a nonreactive utensil, adding more relish and liquid as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

6 Process your filled jars in a water-bath canner for 10 minutes from the point of boiling.

7 Remove the jars from the boiling water with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (as explained in Chapter 1 of this minibook). If you find jars that haven't sealed, refrigerate them and use them within two months.

TIP: This recipe is ready to eat as soon as you're done precooking it. So save one jar to cool for dinner the night you make it.

PER 2-TABLESPOON SERVING: *Calories 51 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 499mg; Carbohydrates 13g (Dietary fiber 0g); Protein 0g*

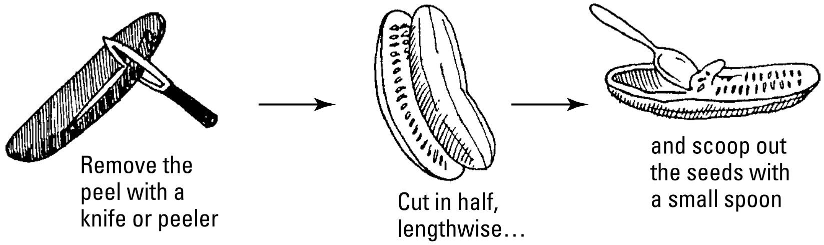

Remove the peel with a knife or peeler
Cut in half, lengthwise…
and scoop out the seeds with a small spoon

FIGURE 4-1: Seeding a cucumber with ease.

Speedy Dill Pickles

PREP: 35 MIN

PROCESSING: PINTS, 10 MIN; QUARTS, 15 MIN

YIELD: 6 PINTS OR 3 QUARTS

INGREDIENTS

4 pounds pickling cucumbers

6 tablespoons kosher or pickling salt

3 cups distilled white vinegar

3 cups water

1 tablespoon whole mixed pickling spices

18 black peppercorns

3 tablespoons dill seed

Fresh dill springs (optional)

1. Wash your cucumbers. Leave them whole if they're smaller than 4 inches in diameter. For larger cucumbers, cut them into slices or lengthwise, in halves or quarters.

2. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see Chapter 2 of this minibook.)

3. Combine the salt, water, and vinegar in a 3- to 4-quart saucepan. Bring the liquid to a boil over high heat, stirring occasionally to dissolve the salt. Keep the liquid hot over medium heat.

4. Snuggly pack the cucumbers into your prepared jars. To each pint jar, add ½ teaspoon of pickling spices, 3 peppercorns, and 1½ teaspoons of dill seed. To each quart jar, add 1 teaspoon of pickling spices, 6 peppercorns, and 1 tablespoon of dill seed. If you're using fresh dill, add a sprig or two to each pint or quart jar in between the inside edge of the jar and the cucumbers.

5. Ladle the hot liquid into your filled jars, leaving ¼-inch headspace in the pint jars and ½-inch headspace in the quart jars. Completely submerge the cucumbers in the liquid. If they protrude from the jar, adjust them until you have the proper headspace, because the lids may not properly seal from the internal pressure. Release any air bubbles with a nonreactive tool, adding more liquid as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

6. Process your filled jars in a water-bath canner for 10 minutes (pints) or 15 minutes (quarts) from the point of boiling.

7. Remove the jars with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (as explained in Chapter 2 of this minibook). If you find jars that haven't sealed, refrigerate and use them within two months.

8. Keep the pickles on the pantry shelf for at least two weeks for the taste to develop.

VARY IT! For kosher-style dill pickles, add 2 cloves of peeled, halved garlic to each jar of pickles.

PER 2-OUNCE SERVING: *Calories 11 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 1,308mg; Carbohydrates 2g (Dietary fiber 1g); Protein 1g*

Zucchini Bread and Butter Pickles

PREP: 40 MIN
SOAKING: 3 HR
PROCESSING: 10 MIN
YIELD: 12 PINTS

INGREDIENTS

6 pounds thinly sliced zucchini
2 cups thinly sliced onions
½ cup kosher or pickling salt
2 cups sugar
2 quarts ice water
2 quarts distilled white vinegar
¼ cup whole mustard seed
¼ cup celery seed
1 teaspoon turmeric

1. Slice the zucchini into ¼-inch thick rounds. Peel the onions and cut them in half lengthwise from the tip to the bottom core. Lay them on a cutting board, cut side down; then slice them, starting at the top of the onion, to a thickness of ¼ inch.
2. Place the zucchini and onion slices in a 12-quart nonreactive stock pot. Sprinkle them with salt. Add ice water to cover the vegetables. Stir them once; then cover the bowl and let the veggies stand at room temperature for 3 hours. Transfer the veggies to a colander and rinse them thoroughly with running water (you may need to do this in more than one batch). Drain well. Roll the pieces in a clean, dry kitchen towel to partially dry them.
3. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see Chapter 2 of this minibook.)
4. In the nonreactive pot, combine the sugar, vinegar, mustard, celery seed, and turmeric. Bring the liquid to a boil over high heat, stirring occasionally to dissolve the sugar and mix the spices. Add the vegetables and return the mixture to a boil.
5. Pack the boiling hot pickles into the prepared jars and add the hot liquid, leaving ½-inch headspace. Release any air bubbles with a nonreactive tool, adding more pickles and liquid as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

6. Process your filled jars in a water-bath canner for 10 minutes from the point of boiling.

7. Remove the jars with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (as explained in Chapter 2 of this minibook). If you find jars that haven't sealed, refrigerate and use them within two months.

TIP: Pick your vegetables when they are cucumber sized, and use that day for the best texture.

NOTE: These pickles are ready to eat as soon as they cool.

PER 2-OUNCE SERVING: *Calories 22 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 116mg; Carbohydrates 6g (Dietary fiber 1g); Protein 0g.*

Pickled Asparagus

PREP: 10 MIN	PROCESSING: 10 MIN	YIELD: 8 PINTS

INGREDIENTS

12 pounds young asparagus spears

8 small dried peppers (optional)

4 tablespoons dill seed

4 teaspoons whole mustard seed

8 cloves garlic

5 cups distilled vinegar

5 cups water

½ cup canning salt

1. Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see Chapter 2 of this minibook.)
2. Wash the asparagus thoroughly and cut it into lengths to fit your pint jars.
3. Place 1 hot pepper, ½ teaspoon dill, ½ teaspoon mustard seed, and 1 clove of garlic in each jar.
4. Firmly pack the asparagus spears vertically into the jars, but don't force them. If necessary, trim the spears to leave ½-inch headspace.
5. In an 8-quart nonreactive pot, combine the vinegar, water, and salt and heat to boiling. Pour the boiling hot solution over the asparagus spears, leaving ½-inch headspace. Release any air bubbles with a nonreactive utensil, adding more liquid as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.
6. Process the filled jars in a water-bath canner for 10 minutes from the point of boiling.
7. Remove the jars from the boiling water with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (as explained in Chapter 2 of this minibook). If you find jars that haven't sealed, refrigerate them and use them within two weeks.
8. Let these beautiful spears sit for two weeks on the pantry shelf for the flavors to develop.

PER ¼-CUP SERVING: *Calories 26 (From fat 5); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 358mg; Carbohydrates 4g (Dietary fiber 2g); Protein 2g*

Dilly Beans

PREP: 16 MIN	PROCESSING: 10 MIN	YIELD: 4 TO 5 PINTS

INGREDIENTS

2½ cups distilled white vinegar

2½ cups water

¼ cup coarse kosher or pickling salt

2½ pounds fresh green beans, washed, with the ends and strings removed

4 stalks fresh dill, washed and drained

4 cloves garlic, peeled

4 dried whole red chile peppers

1 teaspoon cayenne pepper

1 teaspoon dill seed

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see Chapter 2 of this minibook.)

2 Combine the vinegar, water, and salt in a 6- to 8-quart pot. Bring the liquid to a boil over high heat; boil for 1 minute, stirring to dissolve the salt. Reduce the heat to low and keep the mixture hot.

3 Pack the beans into the prepared jars (see Figure 4-2), leaving ¼-inch headspace (trim the tops of the beans, if necessary). Add the following to each jar: a sprig of dill, 1 garlic clove, 1 dried red chile pepper, ¼ teaspoon cayenne pepper, and ¼ teaspoon dill seed.

4 Ladle the hot liquid over the beans, leaving ¼-inch headspace, covering the tops of the beans. Release any air bubbles with a nonreactive tool, adding more liquid as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5 Process your filled jars in a water-bath canner for 10 minutes from the point of boiling.

6 Remove the jars from the boiling water with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (as explained in Chapter 2 of this minibook). If you find jars that haven't sealed, refrigerate them and use them within two months.

(continued)

7 Let the beans sit for two weeks on your pantry shelf for the flavors to fully develop.

VARY IT! Use a combination of green and yellow string beans.

PER ½-CUP SERVING: *Calories 40 (From fat 2); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 167mg; Carbohydrates 10g (Dietary fiber 2g); Protein 1g*

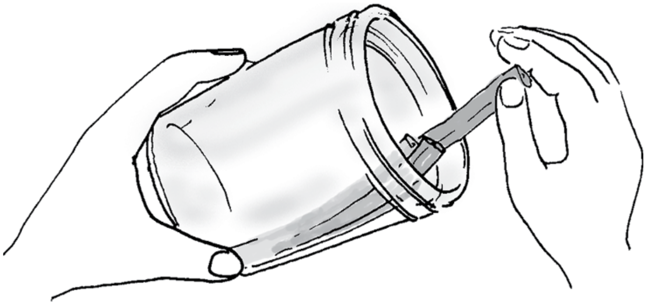


FIGURE 4-2: Packing raw beans into a jar.

Pack raw beans into a jar by holding the jar at an angle on its side

Spiced Pickled Beets

PREP: 95 MIN	PROCESSING: 30 MIN	YIELD: 4 TO 5 PINTS

INGREDIENTS

4 pounds beets

3 cups thinly sliced white or yellow onions (about 3 medium)

2½ cups cider vinegar

1½ cups water

2 cups granulated sugar

1 teaspoon kosher or pickling salt

1 tablespoon mustard seed

1 teaspoon whole allspice

1 teaspoon whole cloves

3 cinnamon sticks, broken into pieces

1 Trim your beets, leaving the taproots and 2 inches of the stems. Wash and drain the beets, using a stiff brush to remove any clinging soil. Cover the beets with water in a 5- to 6-quart pot. Bring the water to a boil over high heat and cook the beets until they pierce easily with a fork, about 20 to 30 minutes. Drain the beets. Run cold water over them and remove the skin. Remove the stem and taproot. Slice the beets into ¼-inch-thick slices. Place the beets in a bowl; set them aside.

2 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see Chapter 2 of this minibook.)

3 Place the onions, vinegar, water, sugar, salt, mustard seed, allspice, cloves, and cinnamon sticks in the pot. Bring the mixture to a boil over high heat; reduce the heat and simmer for 5 minutes. Add your beet slices and simmer the mixture to heat the beets, about 3 to 5 minutes. Remove the cinnamon stick pieces.

4 Pack the hot beets and onions into the hot jars and ladle the hot liquid over the beets, leaving ¼-inch headspace. Release any air bubbles, adding more beets and liquid as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

5 Process your jars in a water-bath canner for 30 minutes from the point of boiling.

(continued)

6. Remove the jars with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (as explained in Chapter 2 of this minibook). If you find jars that haven't sealed, refrigerate them and use them within two months.

TIP: Use beets that are small and tender, not larger than 2 inches in diameter.

TIP: Purchase beets with the top leaves attached. If the leaves are wilted and quite dark, the beets aren't fresh; continue your search for fresher beets.

NOTE: Once canned, these beets are ready for eating.

PER ¼-CUP SERVING: *Calories 71 (From fat 2); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 107mg; Carbohydrates 17g (Dietary fiber 1g); Protein 1g*

Pickled Brussels Sprouts

PREP: 15 MIN	PROCESSING: 10 MIN	YIELD: 6 PINTS

INGREDIENTS

12 to 14 cups young Brussels sprouts

½ cup canning salt

2 cups distilled vinegar

3 tablespoons dill weed

1 Prepare your canning jars and two-piece caps (lids and screw bands) according to the manufacturer's instructions. Keep the jars and lids hot. (For information on preparing your jars, see Chapter 2 of this minibook.)

2 Wash the Brussels sprouts and remove any outer leaves that have insect damage or brown edges. Cook the sprouts for 5 minutes in boiling water and then dip them immediately into cold water. Drain.

3 Pack the sprouts into your hot pint jars, leaving ½-inch headspace. To each jar, add 1½ teaspoons dill weed. Combine the vinegar and salt and pour this solution over the sprouts, leaving ½-inch headspace. Release any air bubbles with a nonreactive utensil, adding more liquid as necessary to maintain the proper headspace. Wipe the jar rims; seal the jars with the two-piece caps, hand-tightening the bands.

4 Process the filled jars in a water-bath canner for 10 minutes from the point of boiling.

5 Remove the jars from the boiling water with a jar lifter. Place them on a clean kitchen towel away from drafts. After the jars cool completely, test the seals (as explained in Chapter 2 of this minibook). If you find jars that haven't sealed, refrigerate them and use them within two weeks.

6 Let your pickled Brussels sprouts sit for two weeks so that the flavors can develop.

PER ¼-CUP SERVING: *Calories 26 (From fat 2); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 475mg; Carbohydrates 6g (Dietary fiber 1g); Protein 1g*

IN THIS CHAPTER

- **Understanding the big chill of freezing food safely**
- **Techniques for freezing your favorite fruits, vegetables, and herbs to enjoy later**

Chapter 5

Freezing

Welcome to freezing, the simplest and least time-consuming method for preserving food. Freezing works well for almost any food. With a minimum of planning and equipment (you may already have most of it), proper storage containers, and basic freezing techniques, keeping food from spoiling and tasting fresh from the garden is easy, convenient, and relatively inexpensive. The results produced from freezing food are superior to canning or drying.

This chapter gives you the basics as well as detailed instructions on freezing some of the fruits and veggies most popular with backyard homesteaders.

Focusing on Freezing

When food is properly prepared, packaged, and quickly frozen, there's no better method for retaining its natural color, flavor, and nutritive value. The process of freezing lowers the temperature of the food to 0 degrees or colder. This low temperature halts microorganism activity by slowing the growth of enzymes. Freezing doesn't sterilize food or destroy the microorganisms; it only stops the negative changes in the quality of your frozen food. The goal with freezing is to preserve the fresh quality of your food.

Temperature: the cold, hard facts

Whether you use your kitchen refrigerator's freezer compartment, an upright standalone model, or a commercial freezer chest, it's critical to keep your freezer at 0 degrees or colder. Frozen food stored at 15 to 20 degrees may appear as solid as food stored at 0 degrees or colder, but the quality of your thawed food stored at the warmer temperature is lower than food stored at 0 degrees or colder.

Packaging foods for freezing

Proper packaging is important for preserving the quality of your frozen food both during the freezing process and after it's thawed. Any excess air in your container may compromise the quality of your thawed food. Remove as much air as possible in bags and wraps, and allow the recommended headspace in rigid freezer containers.

Protecting foods during the storage period requires containers that are easy to seal, suitable for low temperatures, and, most importantly, moisture and vapor proof. For fruits and vegetables, two types of packaging materials meet the criteria for proper freezing: rigid containers and freezer bags. (Freezer paper and wrap is a great choice for meat, but seldom used for the kinds of produce coming out of your garden.)

Rigid containers

Rigid containers are the perfect solution for freezing any soft or liquid food, such as casseroles and soups, and they're reusable. The most desirable material for rigid containers is plastic, although some glass jars are made for freezing. Container sizes range from ¼ of a cup to 1 quart with a variety of sizes in between. Purchase container sizes that fit your freezing needs.

TIP

Choose square- or rectangular-shaped containers. They save space and fit better in your freezer than round containers.

REMEMBER

Rigid containers approved for freezing prevent the spoilers from attacking your food as well as stopping moisture and vapors from penetrating your food. When you use them, be sure to allow the proper headspace so that your food or liquid can expand without forcing the top off (you can find a table listing headspace guidelines later in this chapter). A good rule: Allow ½ inch of headspace for shallow containers and 1 inch for tall containers. For freezing in freezer bags, always press all the air possible out of the bag.

Freezer bags

Freezer bags are readily available, reasonably inexpensive, require a minimum amount of storage space, and come in a variety of sizes. When using freezer bags (we prefer the locking zipper variety), purchase bags labeled for freezing, because the thickness is moisture proof and protects the flavor of your food.

TIP

After placing your food in the bag, force out as much air as possible by folding the filled part of the bag against the nonfilled portion of the bag, pressing the air out while sealing the bag.

TIP

You can use a drinking straw to remove air. Insert one partway into the bag (but away from the food), and then close the bag as much as the straw allows. Suck on the straw to remove the remaining air, quickly slide out the straw, and finish sealing the bag.

VACUUM-SEALING MACHINES

A vacuum-sealing machine is a handy appliance that's great for packaging foods for the freezer. Air is almost completely removed from the package through a suction process, the trademark of this appliance. Most vacuum-sealing machines use materials that are freezer safe or even microwavable and boil-proof. (This is handy for single-serving meals for home or at work.)

Consider these additional items when you're purchasing a vacuum-sealing machine:

- **Cost:** Electric plug-in types range from under $50 for small household models to several hundred dollars for commercial-grade machines. Battery or hand-powered vacuum sealers are available for as little as $10.
- **Replacement bags:** Most machines include bags to get you started. Consider the cost of replacement bags and the reputation of the manufacturer. Investing in a vacuum sealer that is limited by a certain make of bags may limit use of your machine in years to come.
- **Storage requirements:** Depending on the size of your kitchen, storing a vacuum-sealing machine may or may not be an issue. The ideal location for a vacuum sealer is usually on a counter, where you can use it at a moment's notice.

To extend the life of your vacuum-sealing bags, cut them larger than necessary and reseal them each time you remove some of the food inside. This works well for dry products. You can also refill and reseal the bags if the item inside was dry and fresh. This technique is not recommended for juicy foods or meats.

Warming up to thawing out

Following the guidelines for freezing won't guarantee a great product without practicing proper thawing methods. So what's the big deal about thawing? Freezing only halts the growth of microorganisms. After thawing, bacteria and enzymes in your food are free to multiply as if they hadn't been frozen. Keep this growth at a standstill by thawing your food at a low temperature, preferably in a refrigerator, in its freezer container or packaging.

Thaw only what you need, using your food immediately upon thawing. If your food tastes funny or smells odd, harmful microorganisms may be present. Don't hesitate to dispose of any questionable food.

TIP

You don't need to thaw vegetables before adding them to a dish you're cooking. Instead, you can add them directly to the dish in the last 10 minutes of cooking. You can also place frozen unbaked goods directly into the oven to bake. Many previously prepared foods can be placed directly into the oven to reheat and bake as well.

Heat makes the spoilers grow faster, so the lower the temperature during the thawing period, the better for you and the quality of your food. Here are your best options for safely thawing and maintaining the quality of your food:

- **Thawing in your refrigerator:** This is the best and safest process for thawing your food because of the low temperature. Plan your meal the night before and place your choice in your refrigerator to thaw.
- **Thawing at room temperature:** Leave your frozen food at room temperature for 2 hours; then immediately place it in the refrigerator for the remainder of the thawing process. This option is a great alternative if you forgot to take your food out of the freezer the night before.
- **Thawing in the microwave:** Use this method only if your microwave has a defrost cycle. This is important because you want the food to defrost evenly, not be cooked in one portion and frozen in another part.
- **Thawing in water:** Immerse your packaged food in cold water, never hot or warm water. By maintaining the lowest temperature possible when thawing your food, you'll inhibit bacteria and enzyme activity.

REMEMBER

Proper freezing preserves your food for a long time but not indefinitely. You can safely keep all vegetables and most fruits frozen at 0 degrees for as long as 12 months. Citrus fruits have a freezer lifespan of just 3 to 4 months.

WARNING

Certain fruits and veggies with a high water content break down when frozen and become mushy beyond recognition when thawed. Some examples are lettuce, watermelon, citrus fruit, and cucumbers. Tomatoes are an exception to this if you're using them in cooked dishes, such as stews (where the soft, watery texture is desired). Cut fresh tomatoes into quarters and package them in one-cup portions for quick freezing and easy measuring. Don't freeze potatoes; they become watery and grey when thawed, and rendered so mealy that they are rarely suitable even in a cooked dish.

Rethinking refreezing

From time to time, even the best-laid plans change and your defrosted food doesn't get used when you planned. If your food is only partially defrosted, indicated by the presence of ice crystals, it may be refrozen.

Refreezing food shouldn't be a regular practice, but if you're considering it for any reason, keep these things in mind:

- Don't refreeze completely defrosted low-acid foods, such as vegetables or meat sauces, after they reach room temperature. These foods may not be safe to eat.
- You may refreeze high-acid foods and most fruits and fruit products if they're still cold.
- You may safely refreeze partially thawed foods containing ice crystals if the food was thawing in your refrigerator.

REMEMBER

Refrozen foods have a shorter shelf life than when first frozen. They may also taste different. If you refreeze an item, make a note on the package including the refreezing date. Use refrozen food as soon as possible. Follow this simple rule when evaluating refrozen, thawed food: When in doubt, throw it out! Eating spoiled food can be quite dangerous.

Giving Fruit the Freeze

The key to a great frozen product starts with perfect, ripe fruit. Choose only perfect fruit, free of bruises and not overly ripe. Be prepared to process your fruit the day it's picked or immediately after bringing it home from the market.

At the end of this section, you'll find several recipes that will help ensure the freezing success of your favorite fruits.

Preparing your fruit

Fresh fruits require a minimum of preparation before packaging them for the freezer. First you need to wash them and then choose a packing method.

Fruits may be frozen raw, with added sugar, or with added syrup (a mixture of sugar and water). Although adding sugar to your fruit isn't necessary, it's preferred. Occasionally, you'll add an *antioxidant* (an anti-darkening agent) to the liquid to keep your fruit from discoloring.

Following are your packing choices:

- **Dry or unsweetened pack:** When you'll be eating the fruit or using it for pies, jams, or jellies, use this method. No sugar or liquid is added. There may be minor changes in the color, flavor, or texture of your fruit.
- **Dry sugar pack:** This is preferred for most berries unless you're making pies, jams, or jellies (see the preceding bullet). Place your washed fruit on a shallow tray or a baking sheet. Evenly sift granulated sugar over the fruit (a mesh strainer works well). Then transfer the berries to a bowl or a rigid freezer container and allow them to sit. The longer the berries sit, the more juice is drawn out. (It's not necessary for the sugar to dissolve as in the wet-pack-with-sugar method, below.) When your berries are as juicy as you want them, transfer the berries, including the juice, to a rigid freezer container, allowing the recommended headspace (refer to Table 5-2).
- **Wet pack with sugar:** Place your fruit in a bowl and sprinkle it with granulated sugar. Allow the fruit to stand until the natural fruit juices drain from the fruit and the sugar dissolves. Transfer your fruit and the juice to a rigid freezer container, allowing the recommended headspace (refer to Table 5-2).
- **Wet pack with syrup:** Place your fruit in a rigid freezer container, adding syrup (see Table 5-1 for a variety of syrup concentrations) to completely cover the fruit and allowing the recommended headspace (listed in Table 5-2). Your fruit needs to be fully submerged in the syrup before sealing the containers.

  TIP

  To solve the problem of *floating fruit,* fruit rising to the top of the liquid in the jar, wad a piece of moisture-proof paper (foil works well) into a ball. Place it on top of the fruit to force the fruit to stay completely submerged when the container is sealed. Remove the paper after thawing your fruit.

REMEMBER

Not all packing methods are suitable for all fruits. Only methods recommended for each fruit are supplied in the recipes in this chapter.

Syrup concentrations at a glance

As mentioned previously, syrup is a sugar-and-water combination. Table 5-1 lists the different types of syrups. To make the syrup, you simply dissolve the appropriate amount of sugar into water. You can use either cold or hot water. If using hot water, let the sugar syrup cool to room temperature before adding it to fruit.

TABLE 5-1

Syrup for Freezing Fruit

Type of Syrup	Sugar Concentration	Sugar	Water	Syrup Yield
Extra-light	20	1¼ cups	5½ cups	6 cups
Light	30	2¼ cups	5¼ cups	6½ cups
Medium	40	3¼ cups	5 cups	7 cups
Heavy	50	4¼ cups	4¼ cups	7 cups

REMEMBER

The concentration of sugar syrup is up to you, but usually a thin syrup is used to prevent a loss of flavor, especially if the fruit is naturally sweet or mild flavored. A medium to heavy syrup is used for sour fruits, such as sour cherries or grapes. Different recipes may call the syrup concentrations different things. Simply follow the concentrations as specified in the recipe you are using.

TIP

Use these syrup estimates for planning the amount of syrup to make for filling your storage containers:

- **Sliced fruit or berries:** ⅓ to ½ cup of syrup for 1½ cups of fruit in a 1-pint container
- **Halved fruit:** ¾ to 1 cup of syrup for 1½ cups of fruit in a 1-pint container

Headspace guidelines

Headspace is very important when freezing foods. Food expands when frozen, and you need the extra space to allow for this. In addition, if you're using glass jars and don't have enough headspace to accommodate the expanding food, the jars can break. To avoid this problem, use the headspace recommendation for the size containers you have (see Table 5-2).

TABLE 5-2

Headspace Guidelines for a Dry or Wet Pack

Packing Method	Container Opening Size	Pints	Quarts
Dry pack	Narrow mouth	½ inch	½ inch
Dry pack	Wide mouth	½ inch	½ inch
Wet pack	Narrow mouth	¾ inch	1½ inches
Wet pack	Wide mouth	½ inch	1 inch

Frozen Fruit Recipes

Whether you're freezing fruits to use later in baking recipes, as tasty toppings, or for healthy smoothies, the hardest part may be finding enough freezer space to keep all of your favorites on hand throughout the year.

Here's what you need to know about freezing fruits, plus a handful of recipes that will help you produce the best results.

Apples

When freezing apples, use crisp apples with a firm texture such as Pippin or Golden Delicious. Because apples tend to get a little mushy when you defrost them, frozen apples are ideal for use in baked goods.

Berries

Jams, jellies, and preserves made with frozen berries produce a product superior in color, flavor, and texture to one made with fresh berries. The recipe in this chapter uses blueberries, but you can use any type of berry (except strawberries); they all freeze well with this method. (The best way to freeze strawberries is to pack them in sugar, as explained in the later Frozen Strawberries Packed in Sugar recipe.) Whatever berries you choose, make sure they're firm.

Peaches, nectarines, and apricots

In addition to freezing peaches with the recipe in this chapter, you can also freeze nectarines and apricots the same way — all varieties of these fruits freeze well. Use fully ripe fruit without any bruised areas.

Strawberries

Strawberries are put in a category of their own for freezing. Cut them and treat them with sugar or pack them in syrup.

Frozen Apples Packed in Sugar

PREP: 20 MIN | YIELD: 1 PINT

INGREDIENTS

1¼ to 1½ pounds apples

1½ tablespoons lemon juice

8 cups of water

½ cup granulated sugar

1. Peel, core, and slice your apples into 12 or 16 pieces, dropping the slices into 1½ tablespoons of lemon juice to 8 cups of water to keep them from turning brown as you finish them all. (If you prefer, you can use an ascorbic or citric acid solution instead of the lemon juice and water.)

2. Remove the apples from the antioxidant solution and place them in a shallow dish or on a baking sheet. Sprinkle the apple slices with granulated sugar, one part sugar to four parts apples. Let your apples be the guide here: Taste a slice with sugar to see if it is to your liking.

3. Fill your container and allow the proper headspace (refer to Table 5-2) and freeze.

NOTE: Use crisp apples with a firm texture such as Pippin or Golden Delicious. Because apples tend to get a little mushy when you defrost them, these are ideal for use in baked goods.

VARY IT! You can also pack your apples in syrup. To do so, place your drained apple slices in rigid freezer containers, filling them with a cold heavy syrup (refer to Table 5-1), adding ½ teaspoon of an antioxidant solution to each container and allowing the proper headspace (refer to Table 5-2).

PER ½-CUP SERVING: *Calories 168 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 44g (Dietary fiber 2g); Protein 0g*

Quick-Frozen Blueberries

PREP: 15 MIN | YIELD: 1 PINT

INGREDIENTS

1 to 1½ pounds blueberries

1 Gently wash the berries, removing any stems. Spread the washed berries onto a towel-lined cookie sheet and allow them to air dry (about 15 to 20 minutes) to prevent them from sticking together while freezing.

2 Spread your washed berries on a baking sheet, placing it in your freezer. (This process is known as *quick-freezing* or *flash-freezing.*) When the berries are frozen, transfer them to freezer bags or rigid freezer containers.

NOTE: This recipe uses blueberries, but you can use any type of berry (except strawberries). (The best way to freeze strawberries is to pack them in sugar, as explained in the Frozen Strawberries Packed in Sugar recipe.) Whatever berries you choose, make sure they're firm.

VARY IT! To pack your berries in syrup, place the berries into rigid freezer containers, covering them with cold medium syrup (refer to Table 5-1), allowing the proper headspace (refer to Table 5-2). If the berries float, add a ball of moisture-proof paper to keep the berries submerged.

PER ½-CUP SERVING: *Calories 64 (From fat 4); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 7mg; Carbohydrates 16g (Dietary fiber 3g); Protein 1g*

Frozen Peaches Packed in Syrup

PREP: 30 MIN | YIELD: 1 PINT

INGREDIENTS

1 to 1½ pounds peaches

½ cup medium syrup

¼ teaspoon antioxidant

1. Blanch the peaches to remove the skin (don't leave the fruit in the boiling water for more than 1 minute).
2. Place ½ cup of cold medium syrup (refer to Table 5-1) and an antioxidant into each rigid freezer container. Slice or halve the fruit directly into the pint container, discarding the fruit pits.
3. Fill the container with additional syrup, allowing the proper headspace (refer to Table 5-2) and freeze.

TIP: Use freestone peaches to make removing the pit much easier.

NOTE: Use fully ripe fruit without any bruised areas.

NOTE: In addition to freezing peaches with this recipe, you can also freeze nectarines and apricots the same way — all varieties of these fruits freeze well.

PER ½-CUP SERVING: *Calories 65 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 17g (Dietary fiber 2g); Protein 1g*

Frozen Strawberries Packed in Sugar

PREP: 20 MIN

YIELD: 1 PINT

INGREDIENTS

¾ to 1½ pounds fresh strawberries

½ cup sugar

1. Wash your strawberries in water, being careful to not bruise them. Remove the hulls (stems).

2. Slice the strawberries lengthwise into a bowl. Add ¾ cup granulated sugar for each quart of strawberries, stirring the berries to dissolve the sugar. Let the strawberries and sugar sit for 30 minutes for the juice to develop.

3. Transfer your strawberries to rigid freezer containers, allowing the proper headspace (refer to Table 5-2).

VARY IT! To pack your strawberries in syrup, place the sliced strawberries into rigid freezer containers. Fill the containers with a cold medium syrup (refer to Table 5-1), allowing the proper headspace (refer to Table 5-2).

PER ½-CUP SERVING: *Calories 121 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 1mg; Carbohydrates 31g (Dietary fiber 2g); Protein 1g*

Blanching Perfect Vegetables

Like fresh fruit, fresh vegetables are quick and easy to freeze. The key to great frozen vegetables is a process called blanching. *Blanching* scalds the vegetables in boiling water, slows down the enzymes and the spoiling process, and preserves the color, flavor, texture, and nutritive value.

This section spells out how to blanch your favorite vegetables to prepare them for freezing, and then offers detailed recipes to help make the fruits (or veggies, in this case) of your labor last well beyond the harvest.

TIP

Blanching isn't necessary when you're using your frozen vegetables, such as onions, in foods where you're concerned with only flavor and not color.

Blanching requires 100 percent of your attention. Vegetables blanched for too short of a time won't stop the enzymes in the vegetables, and microorganisms start where they were stopped after the vegetables thaw. Vegetables left in the boiling water too long start cooking and may become limp.

Follow these steps for successful blanching:

1. **Wash and drain your vegetables; then remove any peel or skin, if needed. If you're not freezing your vegetables whole, cut them now.**
2. **Bring a 5- to 6-quart pot of water to a boil and fill a large mixing bowl with ice water.**

   Add ice cubes to the mixing bowl because the hot vegetables increase the temperature of the ice bath. Cold stops the cooking process.
3. **Add your prepared vegetables to the boiling water for the amount of time specified in the recipe.**

   Begin timing your vegetables as soon as they're in the boiling water; don't wait for the water to return to a boil.

   TIP

   Blanch your vegetables in batches, no more than 1 pound of vegetables in 1 gallon of water.
4. **Remove your vegetables from the boiling water and plunge them into the ice-water bath, stirring the vegetables and circulating the ice water to stop the cooking process as quickly as possible.**

   Don't leave your vegetables in the ice-water bath longer than they were in the boiling water.

5. **After the vegetables are chilled all the way through, remove them from the ice-water bath and drain them in a colander. If you're dry- packing them, roll them in or lay them on clean, dry kitchen towels to remove excess moisture.**

Frozen Vegetable Recipes

Frozen veggies are a huge time-saver in the kitchen. And freezing your own homegrown crops preserves all the nutritional value of your healthy garden favorites at a fraction of the price of store-bought.

Follow these guidelines when getting your veggies ready for the deep-freeze, and use the recipes later in this section to help achieve perfect results.

Beans

Freezing beans is a great way to have them on hand for quick soups and stews. You can add the frozen beans directly to the dish 10 minutes before it is finished cooking. You can use the following recipe for many types of common beans: Green, string, Italian, or wax all work equally well.

Bell peppers

For the recipe in this chapter, you can use green, red, orange, or yellow peppers. Peppers really make an otherwise boring meal sparkle. Try freezing multiple-colored peppers in the same package. Because bell peppers become a little mushy when you defrost them, they're perfect for use in any cooked recipe.

Broccoli

Broccoli is such an undervalued vegetable. Use the perfectly prepared spears in the Frozen Broccoli recipe in all your soups and casseroles.

Brussels sprouts

Brussels sprouts can be a delicious treat — if they're picked at their freshest and processed right away. Try adding these to your roasted vegetable mix, with browned butter and garlic, or doused with balsamic vinegar for a new twist on this tasty vegetable.

Cauliflower

Cauliflower is great for adding to all your winter dishes. Frozen cauliflower also roasts well; just add with your potatoes and onions to the roasting pan. Don't let this delicious vegetable go unused!

Corn

You can never have enough corn in the pantry. An easy way to keep plenty on hand (and put the prefrozen, store-bought bags to shame) is to freeze your own. Add frozen corn to a soup or stew during the last 5 minutes of cooking. Make sure your corn is sweet when you buy it. It won't taste any sweeter after freezing.

Greens

Greens are easy to grow, inexpensive to buy in the farmer's markets, and really pack a nutritional punch. Try keeping plenty on hand to add some extra flavor to your egg dishes, casseroles, and soups, when fresh vegetables are not available.

Peas

Nothing compares to a fresh garden pea. To preserve their sweet flavor, add them to the dish during the last 5 minutes of cooking. Delicious!

Summer squash

Summer squash includes crookneck, patty pan, and zucchini squash. Are all unbelievably tasty vegetables. Once frozen, they lose their attractive look, but still hold onto that summer-fresh flavor. They are suitable for casseroles and egg dishes, soups and stews, and other dishes that benefit from their great taste.

Winter squash

Winter squash includes banana, butternut, and Hubbard. Winter squashes are known for their creamy smooth flavor. They are usually cooked with brown sugar or honey and are a gorgeous bright orange or yellow color from the high vitamin A content. You can add them interchangeably to any bread, cake, stew, or pancake recipe calling for pumpkin.

Frozen Wax Beans

PREP: 20 MIN

YIELD: 1 PINT

INGREDIENTS

⅔ to 1 pound fresh wax beans

1. Wash and drain the beans. Remove the ends and strings, and cut them into 1-inch pieces.
2. Blanch the beans for 2 to 3 minutes; cool immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.) Spread beans on a dry kitchen towel to dry thoroughly before freezing.
3. Place the cooled beans in quart-sized freezer bags, removing all excess air before sealing and placing the bag in the freezer.

NOTE: You can use this recipe for many types of common beans: Green, string, Italian, or wax all work equally well.

PER½-CUP SERVING: *Calories 26 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 8mg; Carbohydrates 6g (Dietary fiber 3g); Protein 1g*

Frozen Bell Peppers

PREP: 15 MIN | YIELD: 2 PINTS

INGREDIENTS

1 to 3 pounds fresh peppers

1 Wash and drain the peppers. Remove the stems and seeds and slice the peppers into uniform pieces. (***Note:*** You do not blanch peppers before freezing.)

2 Place the bell peppers into a rigid container, leaving the appropriate amount of headspace (refer to Table 5-2). Seal and freeze.

TIP: Bell peppers become a little mushy when you defrost them, so they're best used in a cooked recipe.

PER ½-CUP SERVING: *Calories 15 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 1mg; Carbohydrates 4g (Dietary fiber 1g); Protein 1g*

Frozen Broccoli

PREP: 20 MIN | YIELD: 1 PINT

INGREDIENTS

1 pound fresh broccoli

1. Wash and drain the broccoli, removing leaves and damaged spots. Cut the broccoli spears into ½-inch pieces.
2. Blanch the broccoli for 3 to 4 minutes; cool immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.)
3. Place the cooled broccoli pieces in freezer bags, removing all excess air before sealing the bag and placing it in the freezer.

PER ½-CUP SERVING: *Calories 30 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 29mg; Carbohydrates 6g (Dietary fiber 3g); Protein 3g*

Frozen Brussels Sprouts

PREP: 20 MIN | YIELD: 1½ PINT

INGREDIENTS

1 pound fresh Brussels sprouts

1 Wash and drain the Brussels sprouts, removing the leaves and sorting by size for blanching (the smaller-sized sprouts use the shorter blanching time).

2 Blanch the smaller Brussels sprouts for 3 minutes, the larger for 5 minutes; cool immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.) Spread the blanched Brussels sprouts on a clean kitchen towel to remove all of the excess moisture before freezing.

3 Place the cooled Brussels sprouts in freezer bags, removing all excess air before sealing the bag and placing it in the freezer.

PER ½-CUP SERVING: *Calories 32 (From fat 4); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 17mg; Carbohydrates 7g (Dietary fiber 2g); Protein 2g*

Frozen Cauliflower

PREP: 20 MIN | YIELD: 1 QUART

INGREDIENTS

1¼ pounds cauliflower

Water

White vinegar

1. Wash and drain the cauliflower, removing the leaves and core and breaking the flesh into 1-inch pieces (do not cut).
2. Blanch the cauliflower in a water-vinegar mixture (1 tablespoon of vinegar to 1 gallon of water) for 3 minutes; cool immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.)
3. Place the cauliflower pieces in freezer bags, removing all excess air before sealing the bag and placing it in the freezer.

PER ½-CUP SERVING: *Calories 7 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 8mg; Carbohydrates 2g (Dietary fiber 1g); Protein 1g*

Frozen Corn

PREP: 20 MIN | YIELD: 3 PINTS

INGREDIENTS

4 pounds corn (about 12 ears)

1. Remove the husks and the silk from the corn. Wash the ears.
2. Blanch the ears whole for 4 minutes; cool immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.) Cut the kernels from the corn after cooling.
3. Place the corn in freezer bags, removing all excess air before sealing the bag and placing it in the freezer.

NOTE: Make sure your corn is sweet when you buy it. It won't taste any sweeter after freezing.

PER ½-CUP SERVING: *Calories 47 (From fat 6); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 8mg; Carbohydrates 10g (Dietary fiber 2g); Protein 2g*

Frozen Greens

PREP: 20 MIN | YIELD: 1 PINT

INGREDIENTS

1 to 1½ pounds greens (beet, spinach, or Swiss chard)

1 Wash the greens well, removing any thick stems.

2 Blanch the greens for 1½ minutes, stirring constantly to separate the leaves; cool immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.)

3 Place the cooled greens in freezer bags, removing all excess air before sealing the bag and placing it in the freezer.

NOTE:YOUR actual yield will vary depending on the type of greens you use. Spinach, for example, wilts much more than kale does and produces a smaller yield.

PER ½ CUP SERVING:*Calories 36 (From fat 2); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 320mg; Carbohydrates 7g (Dietary fiber 4g); Protein 3g*

Frozen Shelled Peas

PREP: 20 MIN | YIELD: 1 QUART

INGREDIENTS

2 to 4 cups shelled peas

1 Rinse the peas in cold running water.

2 Blanch the loose peas for 1½ minutes; cool immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.)

3 Place the cooled peas in freezer bags, removing all excess air before sealing the bag and placing it in the freezer.

PER ½-CUP SERVING: *Calories 29 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 1mg; Carbohydrates 5g (Dietary fiber 2g); Protein 2g*

Frozen Summer Squash

PREP: 20 MIN | YIELD: 1 PINT

INGREDIENTS

1 to 1¼ pounds summer squash

1. Wash the squash, remove the stems, and slice it into ½-inch pieces.
2. Blanch the squash for 3 minutes; cool it immediately in an ice bath. (See the earlier section "Blanching perfect vegetables" for complete blanching instructions.)
3. Place the cooled squash in a rigid container, leaving the appropriate amount of headspace. Seal and freeze.

PER ½-CUP SERVING: *Calories 22 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 2mg; Carbohydrates 5g (Dietary fiber 2g); Protein 1g*

Frozen Winter Squash

PREP: 30 MIN | YIELD: 1 PINT

INGREDIENTS

1 to 1½ pounds winter squash

1 Peel the outer skin of the winter squash, scrape out the seeds, and cut the flesh into chunks.

2 Place the squash in a 3-quart saucepan and add enough water to cover the bottom of the pan. Cook the squash over medium-low heat until the flesh is soft, about 10 to 30 minutes. or until a chunk slides off a fork. Remove the squash from the pan and mash it until smooth.

3 Place the mashed squash in a rigid container, leaving the appropriate amount of headspace (refer to Table 5-2). Seal and freeze.

TIP: You can add winter squash to any bread, cake, stew, or pancake recipe calling for pumpkin.

NOTE: Follow this same recipe to freeze pumpkin.

PER ½-CUP SERVING: *Calories 43 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 3mg; Carbohydrates 11g (Dietary fiber 3g); Protein 1g*

Freezing Fresh Herbs

The flavors fresh herbs impart in just about any dish are truly a gift from nature. Frozen herbs are a great compromise when fresh herbs aren't available.

REMEMBER

Thawed herbs are great in cooked dishes, but they aren't suitable as a garnish because they're limp after freezing and thawing. If you grow your own herbs, harvest them early in the day before the sun wilts the leaves. Some herbs that freeze well include basil, chervil, chives, cilantro, comfrey, dill, lovage, mint, parsley, savory, sweet fennel, and thyme.

To prepare fresh herbs for the freezer, follow these steps (see Figure 5-1):

1. **Clean the herbs.**

   Hold the bottom of the stems (don't remove the leaves from the stems) and swish the herbs in a bowl of cool water.

2. **Drain and dry the herbs, gently shaking off any excess water.**
3. **Lay the herb sprigs flat, not touching each other, on a piece of wax paper.**
4. **Starting at one end, roll the wax paper snuggly over the herbs.**

   This keeps the herbs separate and easy to use one sprig at a time.

5. **Place the rolled herbs in a freezer bag, label the package, and freeze.**

   There's no need to thaw the herbs before using them.

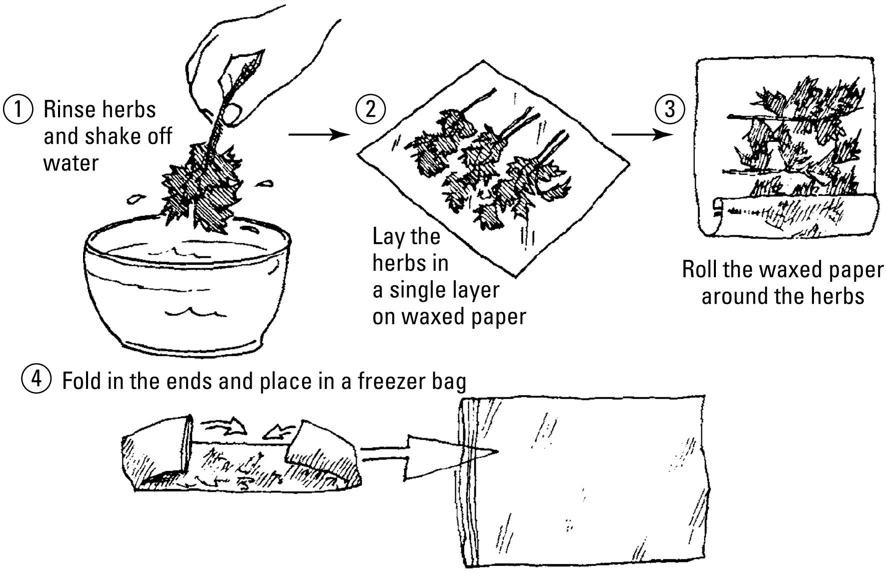
TIP

Some herbs, such as basil, mint, parsley and cilantro, turn black if you freeze the leaves directly. For these herbs, purée them in just enough olive oil to make a paste and then freeze them in ice cube trays. They keep their fresh flavor and color.

TIP

If you're still stumped for more ways you can freeze fresh herbs, try the following:

- **Herb cubes:** After washing the herbs, remove the leaves from the stem and cut them into pieces. Place 1 teaspoon to 1 tablespoon of herbs in each opening of an ice-cube tray. Pour boiling water into the tray and freeze the herb cubes. After the cubes are frozen solid (usually 24 hours) pop them out of the tray and into a plastic freezer bag. When your recipe calls for 1 teaspoon or 1 tablespoon of an herb, add the ice cube to the dish and continue cooking!



① Rinse herbs and shake off water
②
Lay the herbs in a single layer on waxed paper
③
Roll the waxed paper around the herbs
④ Fold in the ends and place in a freezer bag

FIGURE 5-1: Wrapping herbs for freezing.

- **Herbed butter:** Add chopped fresh herbs to one cube of softened, unsalted butter. For a mild herb flavor, start with ¼ cup of herbs, adjusting the amount to your personal taste. Transfer the flavored butter to an ice-cube tray sprayed with no-stick cooking spray and freeze the butter. After the butter is frozen (about 24 hours), remove the butter cubes, placing them in a labeled freezer bag. Serve the flavored butter with bread or add one to a casserole.
- **Herbed butter logs:** Flavor the butter as stated in the previous paragraph. Form the flavored butter into a log in a sheet of wax or parchment paper. Twist the ends, place the log in a freezer bag, and freeze it. Slice off what you need and return the log to the freezer.

IN THIS CHAPTER

- **Comparing easy methods of drying foods for later use**
- **Trying your hand at drying fruits, vegetables, and herbs with step-by-step instructions**

Chapter 6

Drying

In the world of food preservation, sun-drying is the oldest method known. Although canning and freezing require exact applications of processing procedures, drying food isn't exact or precise. Don't be surprised if you find yourself working by trial and error when it comes to knowing how long it takes for your food to reach its degree of doneness. Just follow the general guidelines provided and make adjustments.

In this chapter, you can find basic techniques for drying food, the best drying methods, and recipes for drying your own fruits, veggies, and herbs. Drying is simple and easy to do in your home. Most of the equipment and tools you need, except an electric dehydrator, are probably already in your kitchen.

Opening the Door to Successful Food Drying

Drying food is also referred to as *dehydrating*. The goal is to remove moisture from your food. Achieving a successfully dried product requires removing 80 to 95 percent of the food's moisture. Removing moisture inactivates the growth of bacteria and other microorganisms but doesn't kill them.

The following factors affect your finished product:

- **Heat:** The correct temperature is important in drying food. It must be high enough to force out moisture but not so high that it cooks the food. If your temperature is too high, your food exterior cooks or hardens before the interior of the food dries, trapping moisture in your food — known as *case hardening*. If your temperature is too low or the humidity too high, your food dries too slowly. Both of these dilemmas may cause your food to spoil before you consume it.

  REMEMBER

  The temperature guidelines for drying food are as follows: 125 degrees for vegetables and 135 degrees for fruit. Always follow the instructions for the correct drying temperature for your food in your recipe or the owner's manual for your dehydrator.
- **Dry air:** Dry air absorbs moisture leaving the food in the drying process. The higher the humidity, the longer foods takes to dry because of the additional moisture in the air.
- **Air circulation:** Circulating air carries away moisture absorbed by dry air. This keeps the humidity level constant in the drying chamber.
- **Uniform size:** Pieces of food uniform in size and thickness contain about the same amount of moisture and therefore dry in the same general time, preventing some pieces from not being completely dried and spoiling the entire batch when stored.

Choosing a Drying Method

The three approved methods for drying food are using an electric dehydrator, using a conventional oven, and drying in the sun. All methods work well when you follow basic food-drying procedures, use high-quality fresh food, and practice good sanitation for food preparation.

An electric dehydrator

If you dry a lot of food, an electric dehydrator is a great investment (see Figure 6-1). It's the most reliable method for achieving the most consistent results each time you dry food. This method dries your food evenly and quickly, doesn't tie up your oven, and produces great results in any weather.

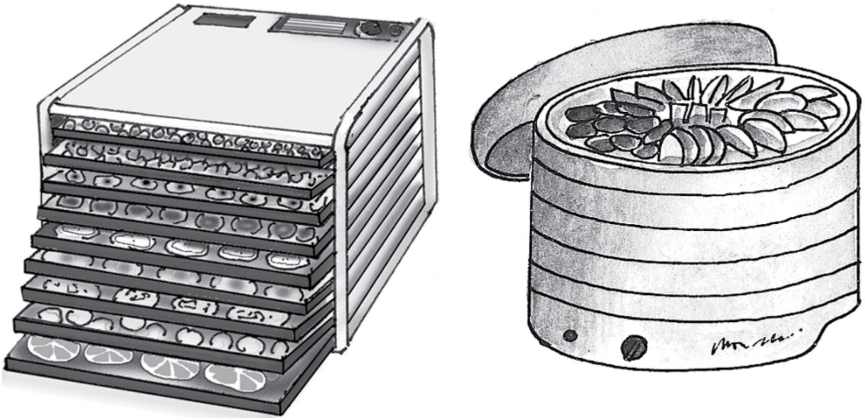


FIGURE 6-1: Two examples of electric dehydrators.

An electric dehydrator dries your food by heating the air inside the chamber to a low temperature and circulating the warm air through the chamber with a fan, passing the heat evenly over your food for the entire drying process. After you place your food in your dehydrator, it needs little or no attention.

To use an electric dehydrator, follow these steps:

1. **Prepare your food according to the recipe and arrange it carefully on the drying trays.**
2. **Following the instructions for using your dehydrator, allow the food to dry for the specified period of time.**

   Turn the pieces of food and rotate the trays from bottom to top to ensure even drying of all the food in the dehydrator.
3. **Test your food for doneness and then label and store it in an airtight container.**

If you're purchasing a dehydrator, carefully assess your needs. Then consider the following factors when making your final decision:

- **Overall construction:** Purchase a unit that's approved for safe home use by the Underwriters Laboratory (UL). If the unit isn't UL approved, don't buy it — it may not be safe for use in your home. Choose one with insulated walls that's easy to clean and drying trays that you can move easily in and out of the dehydrator without disturbing the food.

- **Capacity:** Purchase a dehydrator big enough to hold the amount of food you'll dry at one time. Typically, the most common-sized food dehydrator has four trays. Each tray holds about ¾ to 1 square foot of food. Some dehydrators expand to utilize 30 trays at one time. Snack-size dehydrators with two trays are also available.
- **Heat source:** Select one with an enclosed heating element. Wattage needs to accommodate about 70 watts for each tray the unit holds.
- **Fan:** The fan circulates the heated air around your food. Purchase a dehydrator with a quiet fan, because it runs for long periods of time. If your unit isn't equipped with a fan, you need to rearrange the trays more often during the drying period for an even drying.

  TIP

  When buying a dehydrator secondhand, always plug it in to hear how it sounds when running. The level of noise is not an indicator of quality, but a loud dehydrator needs an out-of-the-way place to run, or it'll be too inconvenient to use.
- **Thermostat:** Purchase a dehydrator with an adjustable thermostat. Your temperature options need to range from 85 to 160 degrees.
- **Drying trays:** Check for trays that are sturdy and lightweight; made from a food-safe product such as stainless steel, nylon, or plastic; and easy to clean. Some manufacturers offer dehydrator accessories such as extra drying trays and trays for drying fruit leather and herbs.
- **Cost:** Dehydrator prices may start as low as $65 and reach $200 or more.
- **Warranty:** Check out the warranty term (one year is a good average) and any restrictions the manufacturer has for your dehydrator.

A conventional oven

If you have an oven — gas or electric — that maintains a temperature between 130 and 150 degrees with the door propped open, you can use your oven to dry food.

REMEMBER

Your oven must maintain a temperature of 130 to 150 degrees for 1 hour to safely dry food; maintaining these acceptable temperatures is difficult unless your oven can be set at less than the standard 200 degrees as the lowest temp. The problem with higher temperatures is that they cook — they don't dry — the food. To test your oven's temperature, put an oven thermometer in the center of your oven with the door propped open.

Oven-drying takes longer than using a dehydrator and costs more because the oven uses a greater amount of electricity than an electric dehydrator does. In addition, if you use your oven for drying, it isn't available for any other use during that time.

To dry food in a conventional oven, follow these steps:

1. **Preheat your oven to the temperature setting in your recipe.**

   Use a separate oven thermometer to check for accuracy. Check the oven frequently to be sure food isn't over- or underdried.

2. **Wash and prepare your food as directed in your recipe.**
3. **Place your filled trays in the oven and leave the door propped open to allow moisture to escape during the specified drying time.**

   If you use baking sheets or other trays without holes or openings in the bottom, you must turn your fruit to achieve an evenly dried product. After the first side of the fruit has absorbed all the liquid on the top of the food, turn it over and repeat this for the other side. After this has been done on both sides, turn the food occasionally until it's done.

4. **Test your food for doneness and then label and store it in an airtight container.**

The sun

Sun-drying is the oldest and least expensive of the three methods and it lets you dry large quantities of food at one time. But — and these are big buts — it's dependent on perfect conditions to produce a safely dried product and it can take days compared to hours in a dehydrator or a conventional oven.

REMEMBER

Weather conditions must be perfect for sun-drying, making only a few climates suitable for this method. The ideal temperature for sun-drying fruit is 85 degrees or hotter for many consecutive days, with the humidity level low to moderate. If your temperature drops more than 20 degrees below your highest temperature during the drying period, your conditions are *not* suitable for this method. You also need good air circulation, a minimum of air pollution, and insect control around the food. Sun drying is even less attractive for drying vegetables because the temperature needs to be at 100 degrees or above for a number of days with the lowest evening temperature never dropping below 80 degrees (even at night) *and* the humidity level needs to be low.

If you're willing to deal with the variances in weather conditions and the lengthy drying time, follow these step-by-step instructions:

1. **Wash and prepare your food as specified in your recipe.**
2. **Line your drying trays or racks with a double layer of cheesecloth or nylon netting.**

3. **Place your food on the tray and cover your trays with a single layer of cheesecloth or nylon netting to protect your food from insects and dust.**

   Stretch the cover tightly over the trays, but don't let it touch the food.

4. **Place your filled trays on benches or tables in full sunlight and check regularly.**

   Check your trays at different times of the day, keeping them in full sun at all times. If your nighttime temperature varies more than 20 degrees from the temperature at the hottest part of the day, move your trays to a warmer area (indoors or an enclosed patio area) for the evening, returning them outside when they can be in full sunlight. Relocate the trays if it rains, regardless of the temperature.

   If you use baking sheets or other trays without holes or openings in the bottom, you must turn your fruit to achieve an evenly dried product. After the first side of the fruit has absorbed all the liquid on the top of the food, turn it over and repeat this for the other side. After this has been done on both sides, turn the food daily until it's done.

5. **Check your fruit daily for evidence of mold.**
6. **Test your food for doneness and then label and store it in an airtight container.**

REMEMBER

If one day is hot and sunny, yet the next is cloudy, you have a problem because mold can develop on partially dried foods before the weather turns back to hot and sunny again. In this situation, you need to use an alternative to sun-drying to finish the foods.

Protecting the Life of Your Dried Food

You'll receive many months of rewarding flavor from your dried foods when they're protected from air, moisture, light, and insects. Generally speaking, food dried and stored properly can be kept from six months to one year.

Cooler air provides a longer shelf life for your food. The best storage temperature is 60 degrees or colder. This will hold your food for at least one year. Temperatures between 80 and 90 degrees preserve the quality of your dried food for only about three to four months.

REMEMBER

Check your unused dried food from time to time for any visible moisture or spoilage. If the food has signs of moisture, such as droplets of liquid in the containers, your food isn't completely dried. Use it immediately or repeat the dehydrating process and repackage it.

Suitable storage containers include the following:

- **Glass**: Home-canning jars with two-piece caps (see Chapter 1 of this minibook) are a perfect choice for storing dried food. Wash them with hot soapy water and rinse them well or wash them in a dishwasher. Dry and cool your jars completely before filling them and adding the two-piece caps. Reusing glass jars with lids also works well. Remove the cardboard liner that sometimes lines the underside of the plastic lid before washing and filling with herbs.
- **Plastic:** Heavy-duty (freezer) plastic bags with locking zipper-style seals work well. After placing your dried food in the bag, roll the bag to remove any extra air and press the seal together, making the bag airtight.
- **Metal:** If you buy coffee in cans, line the inside of a clean can with heavy plastic wrap, place your food inside, and add the tight-fitting lid.
- **Vacuum sealers:** If you own one of these units, now's the time to use it. Check your owner's manual for operating instructions and start packaging your dried food.

Always label your container with the type of food it contains, the date of processing, and, if you measure your food before placing it into the storage container or bag, list the amount.

TIP

Because some pieces of fruit contain more moisture than others, be sure all your fruit is dried the same for storage. Try this tip from the Oregon State Extension Office: Fill a plastic or glass container with cooled, dried fruit about ⅔ full. Cover or seal tightly. Shake the container daily for two to four days. Excess moisture in some of the fruit will be absorbed by drier pieces. Vegetables dry almost completely; you don't have to do this with them.

Snacking on the Run: Drying Fruit

Dried fruit has many uses — from snacks to sauces, dessert toppings to baked-good fillings. Using the best, perfectly ripe fruit for drying is important for a dried fruit that's worthy of high marks and rave reviews. Most fruit is suited for this process with a few exceptions. Fruits *not* recommended for drying include avocados, citrus fruits (except for the peel), crab apples, guavas, melons, olives, pomegranates, and quinces.

Cutting it down

Drying time is determined by the moisture in your fruit, the size of your fruit pieces, the moisture in the air (even if you're using a dehydrator or an oven), and the pretreating method you choose. Larger pieces of fruit take longer to dry than smaller pieces of the same fruit. So the smaller you cut your peaches or the thinner you slice your bananas, the less time you need to produce a safely preserved dried product.

REMEMBER

Fruit contains a lot of water, and you may be surprised at just how much volume you lose when you dry it. So don't be put off by the amount of fruit you start with, wondering where you're going to store it all. Four pounds of fresh blueberries, for example, makes 1¼ cup dried blueberries. And the best news? All the taste and nutrition is still there. All that's missing is the water.

Pretreating your fruit

Pretreating makes your fruit look good by preventing *oxidation* and *discoloration,* the darkening of the fruit flesh after it's exposed to air. This process retards the enzyme activity in the fruit that causes it to ripen.

REMEMBER

Pretreating only slows down the ripening process in fruit; it doesn't stop it.

Using a pretreating method before drying your fruit isn't as important as when you're canning fresh fruit. In fact, it's not necessary at all, but it does assist you with the drying process by shortening the drying time.

The following section explains your pretreating choices.

WARNING

At one time, sulfuring fruit was popular for preserving fruit color and vitamins in dried fruit. Sulfur is unsafe for any drying method other than sun-drying because the sulfur produces dangerous fumes of sulfur dioxide when it's heated, which occurs when you dry fruit in an oven or a dehydrator. People with asthma or other allergies should avoid this product.

Water blanching

Water blanching is the best for maintaining the bright fruit color. Immerse the fruit in boiling water for a short period of time and then immediately plunge it into ice water to stop the cooking process started from the boiling water. Drain the fruit well.

Steam blanching

Steam blanching is the most common method used for fruit. The steam quickly heats the fruit, shortens the drying and rehydrating times, sets the color and flavor, and slows down the enzyme activity, in some cases killing microorganisms. In fact, fruit retains more of its water-soluble vitamins and minerals from steam blanching than water blanching.

To steam blanch, hang a colander on the inside edge of a pot of boiling water, making sure the colander doesn't touch the water. Place your fruit in the colander and heat it as directed in your recipe. Cool your fruit quickly in a bowl of ice water. Drain the fruit well.

Dipping in a solution

With this method, you immerse your fruit into a liquid or a solution to control darkening. Dipping the fruit helps it retain vitamins A and C that are lost during the oxidation process. You can use any of the following liquids:

- **Lemon or lime juice:** Fresh citrus juice is the most natural of the dipping solutions. Mix 1 cup of juice with 1 quart of water. Soak the fruit no longer than 10 minutes; drain thoroughly before drying.
- **Ascorbic acid:** This white, powdery substance is available in drugstores. Its common name is vitamin C. Dissolve 1 tablespoon of powder in 1 quart of water. Don't soak your fruit longer than 1 hour; drain it well before drying.
- **Commercial antioxidants:** These products are found in supermarkets or where canning supplies are sold. Some common brand names are Fruit-Fresh and Ever-Fresh. Follow the directions on the product package for making your solution and determining the soaking time.

Enjoying the labors of your drying

Most dried fruit is used just as it's stored after the drying process. It's great added to hot or cold cereal or baking batters. It's perfect if you're always on the go: It travels well and can be eaten right out of the container. For a fun twist to your teas, add a few dried berries to your teapot before steeping. The berries will lightly infuse the pot of tea with sweetness.

If you prefer your dried fruit a bit chewier, soften or rehydrate it. *Rehydrating* is the process of adding moisture back to the fruit. Use rehydrated fruit right away because it's not dry enough to go back on the shelf without spoiling.

Your rehydrating options are

- **Boiling water:** Place the desired amount of fruit in a bowl. Cover the fruit with boiling water, allowing it to stand for 5 to 10 minutes to plump, or add moisture, to your fruit. Use this method when adding fruit to jams, chutney, or baked goods. Substitute fruit juice or wine for water.
- **Steaming:** Place your fruit in a steamer or a colander over a pot of boiling water (refer to steam blanching earlier in this chapter). Steam your fruit for 3 to 5 minutes or until the fruit plumps.
- **Sprinkling:** Put your fruit in a shallow bowl. Sprinkle the fruit with water or fruit juice. Allow it to soak in the moisture. Repeat the process until the fruit reaches the level of moistness you desire.

Dried Fruit Recipes

Dried fruit is ideal for dropping into baked goods, as a healthy addition to kids' lunchboxes, as a healthy and satisfying snack, or for grabbing on the go.

This section gives you a few things to keep in mind when choosing fruit to be dried, and then presents easy recipes that you and your family will love.

Apples

Apples with tart flavors and firm texture dry best. Some good choices are Pippin, Granny Smith, Jonathan, and Rome Beauty.

Apricots

Even though apricots are one of the most naturally sweet-tasting fruits right off the tree, dehydrating makes them taste even better!

Blueberries

Blueberries will make a nice surprise for your family. Use them in place of raisins and listen to them rave! Use plump berries that aren't bruised.

Cherries

Drying cherries only enhances their rich taste. They taste great out of hand or in your next muffin recipe. Any sweet or sour cherries work well.

Citrus

Dried citrus peel make a great addition to your tea. It gives a fruity zip to desserts and sweetbread recipes. Try citrus peel in muffins and cakes. Use grapefruit, lemon, lime, oranges, or tangerines with unblemished skin. Don't use fruit with color added.

Pineapple

If you have never tasted a dried pineapple, you're in for a huge surprise! Drying creates a chewy morsel that is packed with sweet flavor. Use fully ripe fruit.

Puréed fruit

Fruit leather is dried puréed fruit rolled up in plastic. The result is a chewy, fruity, taffylike treat. Some good choices for fruit leathers are apples, apricots, berries, cherries, nectarines, peaches, pears, pineapple, and plums. If you try drying nothing else, fruit leather is a *must* have. It is so delicious that your family will never guess how nutritious it is.

Dried Apples

PREP: 20 MIN	DRYING: 6 TO 8 HR	WATER CONTENT: 84%	YIELD: 1½ CUPS

INGREDIENTS

4 pounds firm apples

1. Wash, peel, and core your apples. Slice the apples into ¼- to ½-inch thick rings (see Figure 6-2). Dip the apple slices in your choice of dipping solution (refer to "Pretreating your fruit" in this chapter for your options and detailed instructions).

2. Arrange the apple slices on your trays and dry in a conventional oven or dehydrator for 6 to 8 hours at 130 to 135 degrees, rotating the trays occasionally to facilitate even drying. (Sun-dry for 2 to 3 days.)

3. Test for doneness: The apples should be soft, pliable, and leathery.

NOTE: Apples with tart flavors and firm texture dry best. Some good choices are Pippin, Granny Smith, Jonathan, and Rome Beauty.

PER ¼-CUP SERVING: *Calories 147 (From fat 7); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 38g (Dietary fiber 5g); Protein 0g*

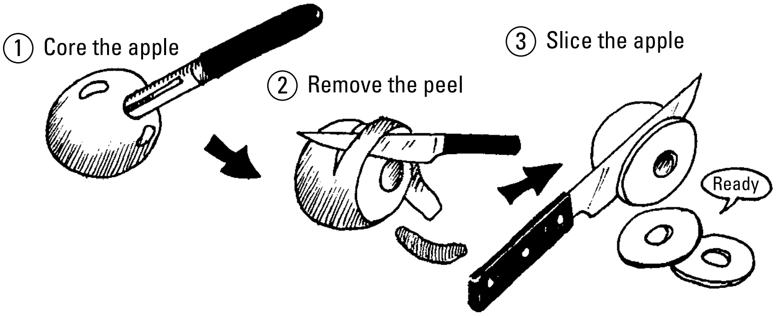


FIGURE 6-2: Cutting apple rings.

Dried Apricots

PREP: 20 MIN	DRYING: 18 TO 20 HR	WATER CONTENT: 85%	YIELD: 2 CUPS

INGREDIENTS

6 pounds fresh apricots

1 Wash the apricots and then them cut in half, discarding the pits. Dip the apricot halves in your choice of dipping solution (refer to "Pretreating your fruit" in this chapter for your options and detailed instructions).

2 Arrange the apricot halves on your trays, skin side down, cut side up. Dry them in a conventional oven or dehydrator for 18 to 20 hours at 130 to 135 degrees, rotating the trays occasionally to facilitate even drying. (Sun-dry for 2 to 3 days.)

3 Test for doneness: The apricots should be pliable and leathery with no moisture pockets.

PER ¼-CUP SERVING: *Calories 152 (From fat 11); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 3mg; Carbohydrates 35g (Dietary fiber 8g); Protein 4g*

Dried Blueberries

PREP: 20 MIN	DRYING: 24 HR	WATER CONTENT: 83%	YIELD: 1¼ CUPS

INGREDIENTS

4 pounds fresh blueberries

1. Drop the blueberries into boiling water for 30 seconds. Remove them from the water and drain. Place the drained berries on paper towels to remove any excess water.
2. Place the blueberries on your trays and dry in a conventional oven or dehydrator for about 24 hours at 130 to 135 degrees, rotating the trays occasionally to facilitate even drying. (Sun-dry for 2 to 4 days.)
3. Test for doneness: The blueberries should be leathery and hard, but shriveled like raisins.

PER ¼-CUP SERVING: *Calories 203 (From fat 12); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 22mg; Carbohydrates 51g (Dietary fiber 10g); Protein 2g*

Dried Cherries

PREP: 20 MIN
DRYING: 14 TO 28 HR
WATER CONTENT: SWEET CHERRIES, 80%; SOUR CHERRIES, 84%
YIELD: 2 CUPS

INGREDIENTS

6 to 8 pounds fresh sweet or sour cherries

1. Wash the cherries in cold water. Then cut them in half and remove the pits.
2. Place the cherry halves on your trays skin side down, cut side up. Dry them in a conventional oven or dehydrator for 2 to 3 hours at 165 degrees, or until there is a slightly leathery appearance to the skin and cut surface. Then reduce the heat to 135 degrees and dry for an additional 12 to 25 hours. (Sun-dry for 2 to 4 days.). Rotate the trays occasionally to facilitate even drying.
3. Test for doneness: The cherries should be leathery, hard, and slightly sticky.

PER ¼-CUP SERVING: *Calories 220 (From fat 27); Fat 3g (Saturated 1g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 51g (Dietary fiber 7g); Protein 4g.*

Dried Citrus Peel

PREP: 20 MIN	DRYING: 1 TO 2 HR	WATER CONTENT: 86%	YIELD: ⅛ CUP

INGREDIENTS

1 pound fresh oranges

1. Wash the citrus fruit and remove a thin layer of peel with a vegetable peeler. Be careful not to get any of the white, bitter pith. If you do, don't use that part of the peel.
2. Arrange the peel on your trays and dry in a conventional oven or dehydrator for 1 to 2 hours at 135 degrees, rotating the trays occasionally to facilitate even drying. (Sun-drying is not recommended.)
3. Test for doneness: The peels should be crisp, but not brittle.

NOTE: You can also use grapefruit, lemon, lime, or tangerines with unblemished skin. Don't use fruit with color added.

PER 1-TEASPOON SERVING: *Calories 2 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 1g (Dietary fiber 0g); Protein 0g*

Dried Pineapple

PREP: 20 MIN	DRYING: 12 TO 18 HR	WATER CONTENT: 86%	YIELD: 1½ CUPS

INGREDIENTS

6 pounds fresh pineapple

1 Cut away the peel and the eyes from the pineapple and remove the core. Cut the flesh into ¼-inch-thick rings.

2 Arrange the pineapple rings on your trays and dry in a conventional oven or dehydrator for 12 to 18 hours at 130 to 135 degrees, rotating the trays occasionally to facilitate even drying. (Sun-dry for 4 to 5 days.)

3 Test for doneness: The pineapple rings should be leathery and not sticky.

TIP: Use fully ripe pineapple.

PER ¼-CUP SERVING: *Calories 116 (From fat 9); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 2mg; Carbohydrates 29g (Dietary fiber 3g); Protein 1g.*

Fruit Leather

PREP: 20 MIN OR LONGER	DRYING: 6 TO 18 HR	YIELD: 4 CUPS OF FRUIT PURÉE MAKES 8 TO 12 SERVINGS

INGREDIENTS

One of any of the following fresh fruits:

2 to 3 pounds apples (about 8 to 12)

3 to 4 pound apricots (about 24)

3 to 4 pound peaches (about 8 to 12)

4 pints strawberries

Water or fruit juice (optional)

Corn syrup or honey (optional)

⅛ teaspoon ground spices (optional): choose from allspice, cinnamon, cloves, ginger, mace, nutmeg, or pumpkin pie spice

¼ to ½ teaspoon pure extract flavors (optional): choose from almond, lemon, orange, or vanilla

1 Cover your drying trays or baking sheets with a heavy-duty, food-grade plastic wrap. If your dehydrator comes with special sheets for your trays, use those. For this recipe, 2½ cups of puree covers an area, ¼-inch thick.

2 Wash your fruit and remove any blemishes. Prepare your fruit as directed in the guidelines for preparing fruit in this chapter.

3 Purée the fruit in a blender until smooth. Strain out any small seeds, if desired, with a mesh strainer or a food mill. If your purée is too thick, add water or fruit juice, 1 tablespoon or less at a time. If your purée is too tart, add corn syrup or honey, 1 teaspoon at a time. If you're adding spices or other flavorings, add them now.

4 Spread the purée onto the prepared trays to a thickness of ⅛-inch in the center and ¼-inch-thick around the edges (you want the edges thicker than the center because the edges dry faster). See Figure 6-3. If you use cooked fruit, it must be completely cool before spreading it on the trays.

5 Dry your fruit leather at a temperature of 135 degrees in a dehydrator or 140 degrees in a conventional oven. Dry the fruit until it's pliable and leatherlike with no stickiness in the center. The amount of time will depend on the amount of moisture in the fruit; about 6-8 hours in an electric dehydrator, or up to 18 hours in a conventional oven.

6 Roll the warm fruit leather, still attached to the plastic, into a roll. Leave the rolls whole, or cut them into pieces with scissors. Store the rolls in a plastic bag or an airtight container.

NOTE: Some other good choices for fruit leathers are cherries, nectarines, pears, pineapple, and plums.

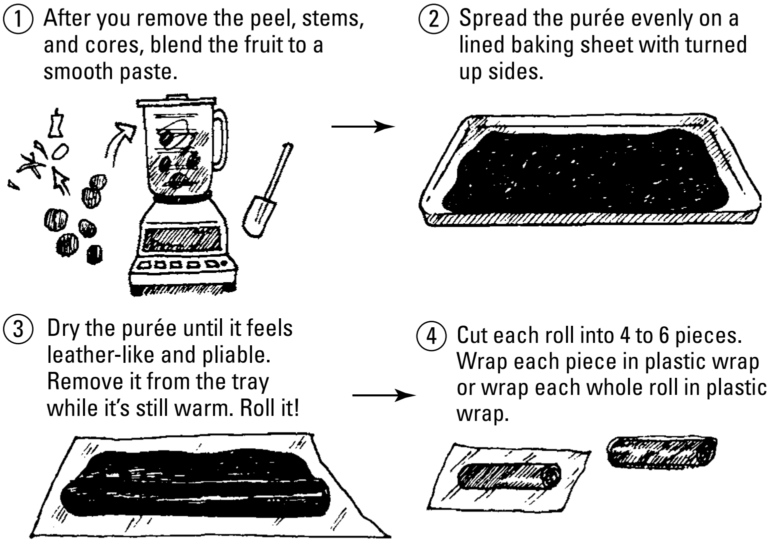
NOTE: The spice flavoring will intensify as this dries. Use a light hand, and no more than⅛ of a teaspoon total in each batch.

PER ½-CUP SERVING OF APPLE PURÉE: *Calories 55 (From fat 3); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 14g (Dietary fiber 2g); Protein 0g*

PER ½-CUP SERVING OF APRICOT PURÉE: *Calories 76 (From fat 6); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 2mg; Carbohydrates 18g (Dietary fiber 4g); Protein 2g*

PER ½-CUP SERVING OF PEACH PURÉE: *Calories 64 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 0mg; Carbohydrates 16g (Dietary fiber 3g); Protein 1g*

PER ½-CUP SERVING OF STRAWBERRY PURÉE: *Calories 43 (From fat 5); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 1mg; Carbohydrates 10g (Dietary fiber 3g); Protein 1g*



① After you remove the peel, stems, and cores, blend the fruit to a smooth paste.

② Spread the purée evenly on a lined baking sheet with turned up sides.

③ Dry the purée until it feels leather-like and pliable. Remove it from the tray while it's still warm. Roll it!

④ Cut each roll into 4 to 6 pieces. Wrap each piece in plastic wrap or wrap each whole roll in plastic wrap.

FIGURE 6-3: Preparing and rolling fruit leather.

Drying Vegetables for Snacks and Storage

Drying foods is a super way to store a large amount of food in a surprisingly small space. If you are short on pantry space or lack more than a small freezer in the kitchen, drying may be the perfect storage solution for you. It's easy to mix and match your family's favorite vegetables and create easy to store and use vegetables for your pantry.

As discussed earlier, there are different methods you can use for drying food. For vegetables, a food dehydrator is your best bet because a controlled, clean heat combined with constantly moving air results in a completely dried vegetable. To use a dehydrator, you simply layer your vegetables onto stacked trays and turn on the unit. Some dehydrators have fans that blow the warmed air over the drying food. Other units have a heating element at the bottom, and as the warm air rises, it filters through all the trays, drying the produce in the process.

Drying know-how

Although drying seems pretty, well, cut and dried (pick the freshest vegetables you can find, prepare them as necessary, and put them in a food dehydrator for the required time and temperature), you can ensure that you'll end up with a tasty, edible veggie by following some basic rules:

TIP

- Not all vegetables need to be peeled before drying. Leaving on clean, washed skin increases the final nutritional content. Peels often contain fiber and other nutrients that only add to the overall benefit of the vegetable. You can find the best prep method in the drying instructions.
- While your vegetables are drying, switch the trays around to ensure they all get even heat. For best results, be sure to cut all the food into evenly sized pieces and spread the pieces in a thin layer on the drying trays.

WARNING

- Some vegetables dry faster than others due to the water content of the vegetable while fresh. When setting up your trays, don't mix juicy vegetables with those that are drier.

  Vegetables with different water content can have much different drying times. If you dry them all together, you can end up with mildew because some may not get completely dehydrated.

- Make sure the vegetables are completely dried before sealing. To know that, you need to know what a properly dried vegetable looks and feels like. Not all are crispy when dried. Often, a vegetable is dried properly and yet remains pliable. (You can find out how to tell whether a vegetable is properly dried in the vegetable-specific sections that appear later in the chapter.)

REMEMBER

The drying process involves many factors: moisture in the food that is being dried, the accuracy of the thermostat in the dehydrator, how full the trays are, and the humidity on the day you are drying. You may have to experiment a bit to figure out what works best. The drying process is not as accurate as other methods in this book, such as canning and freezing. The final goal is to remove enough moisture so that organisms that spoil food cannot grow.

Storing and using your dried produce

When you take the vegetables from the dehydrator, they're ready to be stored in an airtight container in a cool, dry place out of direct sunlight.

TIP

For best results, store batches of vegetables together, but keep them in separate containers. For example, keep all dried tomatoes in a gallon jar, but inside the jar, divide them into separate storage bags, with each bag holding tomatoes dried on different days. This way, if something isn't quite right about a particular batch of vegetables, your entire season's storage isn't ruined.

You can store dried vegetables for up to a year as long as they are kept dry and out of sunlight.

Dried vegetables can be used for snacking and adding to soups and stews in the last few minutes of cooking. To rehydrate your dried vegetables add 1½ cups boiling water to 1 cup of dried vegetables. Let them stand for 20 to 30 minutes to absorb the water. If all the water is absorbed and they're not as plump as you'd like, add about 2 cups additional water and let them stand until most of the water is absorbed. Use the vegetables as you would raw ones; cook them or add them to a soup or stew. A good rule of thumb is 1 cup of dried vegetables equals two cups of reconstituted vegetables.

TIP

Avoid pouring or sprinkling vegetables over a steaming pot, straight from the storage container. Doing so can cause the moisture from the steam to condense in the container and promote mold. Always pour dried vegetables into a separate dish or your hand before adding to your recipe.

Dried Vegetable Recipes

Dried veggies make for a fun snack and are also a superb pantry item that can quickly bolster soups and stews and many other recipes at a moment's notice.

The tips that start this section and the recipes that follow will help you dehydrate your favorite vegetables with great results.

Shell beans

Dried shell beans take up little room on the pantry shelf. Store yours in quart-sized jars because they look so pretty and are easy to pour from.

Beets

For drying beets, choose young, firm beets. Avoid large ones that can be fibrous. To use dried slices, eat them as-is or boil for 30 minutes in plain water, until soft once again.

Carrots

The best carrots for drying are young and tender. You can add dried, shredded carrots as-is to sweetbreads and cakes for added fiber and natural sweetness; they'll absorb moisture and become delicious during the cooking process. You can also add dried slices to any soup or stew and simmer until tender, about 30 minutes. Or try sprinkling shredded carrot directly into eggs when making omelets. They'll cook as the eggs do and add a colorful look to the dish.

Greens

Select young, fresh greens for drying. To use, crumble dried greens into broth, tomato-based sauces, stews, and any other dish that you want to add some nutritional punch to.

Peas

Choose young green peas when they are at their peak of flavor. They shrivel up quite a bit when dried but plump up nicely when added back to water or broth. Add dried peas to broth or stew and simmer for 30 minutes.

Potatoes

Select young, unblemished potatoes for drying. Because they have such a long drying time, plan on drying potatoes overnight. To use dried potatoes, cover them with water and bring to a simmer until soft again — about 45 minutes. Dried sweet potatoes make a great snack as-is.

Zucchini

Young zucchini usually have no seeds to deal with, and the skin may be soft enough to leave on before slicing, cubing, or grating in advance of drying. If you're working with mature zucchini, remove the seeds and surrounding pulp and peel off the hard skin.

Dried Shell Beans

PREP: 10 MIN	DRYING: 6 TO 8 HR	YIELD: 1½ CUPS

INGREDIENTS

1 pound of shell beans of your choice

1 Remove the pods and collect the beans. Place the beans on the dehydrator tray(s) in a single layer, adding enough to fill, but be sure that the beans are in a single layer on the trays.

2 Set your dehydrator temperature to 120 degrees and dry the beans for 6 to 8 hours, or until you can break a bean in half by hitting it with a hammer or other heavy object. Rotate the trays occasionally to facilitate even drying.

3 Remove your dried beans from the trays, place them in a tightly sealed container, and freeze them overnight to kill any tiny bug eggs that may be hiding in them.

4 Store your dried beans for up to one year.

PER ½-CUP SERVING: *Calories 129 (From fat 10); Fat 1g (Saturated 0g); Cholesterol 0mg; Sodium 37mg; Carbohydrates 26g (Dietary fiber 6g); Protein 12g*

Dried Beets

PREP: 10 MIN | DRYING: 8 TO 10 HR | YIELD: 2 CUPS

INGREDIENTS

2 pounds of beets

1 Cut off the leaf and root ends of your beets and cook the beets in boiling water just long enough to slip the skins off easily (this may take from 5 to 15 minutes). Thinly slice the beats and arrange them in a single layer on your dehydrator trays.

2 Set your dehydrator temperature to 120 degrees and dry the beets for 8 to 10 hours, or until the slices are hard. Rotate the trays occasionally to facilitate even drying.

3 Place the dried beets in an airtight container and store for six months in a cool dry place, out of direct sunlight.

TIP: An easy way to get the skin off a beet is to drop each boiled beet into ice water for a few seconds before pulling off the skins.

PER ½-CUP SERVING: *Calories 65 (From fat 2); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 119mg; Carbohydrates 15g (Dietary fiber 4g); Protein 2g*

Dried Carrots

PREP: 10 MIN	DRYING: 8 TO 10 HR	YIELD: 1 CUP

INGREDIENTS

1 pound fresh carrots

1. Scrub the carrot skin with a vegetable brush to remove any trace of dirt. Cut off the tops and about ¼ inch of the carrot itself to remove any of the green, bitter part of the carrot. Then cut the carrots into ⅛-inch slices or shred finely. Blanch the slices or shreds for 2 minutes in boiling water and then cool immediately in ice water. Drain well. Layer carrot slices or shreds in a single layer on your dehydrator trays.

2. Set the temperature on your dehydrator to 120 degrees and dry the carrots for 8 to 10 hours, or until they're tough and leathery, stirring at least once to ensure that the pieces don't stick and rotating the trays periodically to facilitate even drying.

3. Store the dried carrots for up to one year in a tightly sealed container.

TIP: To remove as much water as possible from the blanched carrots, especially for shreds, use paper towels.

PER ½-CUP SERVING: *Calories 102 (From fat 0); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 116mg; Carbohydrates 23g (Dietary fiber 6g); Protein 3g*

Dried Greens

PREP: 10 MIN	DRYING: 4 TO 6 HR	YIELD: ¼ CUP

INGREDIENTS

1 pound fresh greens

1. Trim and wash the greens thoroughly to remove any fine grit. Blanch the greens until they are limp, about 2 minutes. Spread them in a thin layer onto your drying trays.
2. Set the temperature on your dehydrator to 120 degrees and dry the greens for 4 to 6 hours, or until the greens are crispy, stirring once to keep them from sticking together and rotating the trays occasionally to facilitate even drying.
3. Store your dried greens for up to one year in a tightly sealed container.

NOTE: Check drying greens carefully to ensure they are layered loosely enough to fully dry. Greens that are stuck together may hold moisture and develop mold.

VARY IT! You can create a powder to add as-is to any sauce or baked good. Simply pulverize the dried greens in a food processor and then dry them in your dehydrator for at least 4 hours.

PER ¼-CUP SERVING: *Calories 227 (From fat 29); Fat 3g (Saturated 0g); Cholesterol 0mg; Sodium 195mg; Carbohydrates 45g (Dietary fiber 9g); Protein 15g*

Dried Peas

PREP: 5 MIN | DRYING: 9 TO 12 HR | YIELD: ¼ CUP

INGREDIENTS

1 pound fresh peas

1 Shell and blanch your peas for 2 minutes in boiling water; then chill in ice water and drain. Arrange the peas in a thin layer on your drying trays.

2 Set the temperature on your dehydrator to 120 degrees and dry until the peas are shriveled and hard, about 9 to 12 hours, stirring at least once to prevent sticking and rotating the trays periodically to facilitate even drying.

3 Store your dried peas for up to one year in a tightly sealed container.

PER ¼-CUP SERVING: *Calories 367 (From fat 16); Fat 2g (Saturated 0g); Cholesterol 0mg; Sodium 23mg; Carbohydrates 66g (Dietary fiber 23g); Protein 25g*

Dried Potatoes

PREP: 10 MIN	DRYING: 10 TO 12 HR	YIELD: ¾ CUP

INGREDIENTS

1 pound potatoes (about 4 to 5 medium)

1 Wash and peel the potatoes. Cut them into ½-inch strips for shoestring potatoes, or ⅛-inch slices, making sure all pieces are of uniform size for even drying. Blanch the potatoes for 5 minutes and drain. Arrange them in a single layer on your drying trays.

2 Set the temperature on your dehydrator to 120 degrees and dry the potatoes until they're hard and brittle, at least 10 to 12 hours, stirring after the first 4 hours to prevent sticking. Rotate the trays occasionally to facilitate even drying.

3 Store the dried potatoes for up to one year in a tightly sealed container or in plastic freezer bags.

TIP: To prevent your potatoes from turning brown during drying, dip them in a mixture of 2 tablespoons lemon juice to 1 quart of water prior to drying.

PER ¼-CUP SERVING: *Calories 108 (From fat 1); Fat 0g (Saturated 0g); Cholesterol 0mg; Sodium 6mg; Carbohydrates 25g (Dietary fiber 2g); Protein 2g.*

Sweet Potato Crunch Sticks

PREP: 10 MIN | DRYING: 12 HR | YIELD: 8 SERVINGS

INGREDIENTS

1 pound sweet potatoes, washed, peeled and sliced into shoestrings

1 tablespoon olive oil

½ teaspoon sea salt

1 Blanch the shoestring sweet potatoes in boiling water for 5 minutes and dip in ice cold water. Drain well. Dry the potatoes on paper towels to remove any outside moisture.

2 Place the sweet potatoes in an 8-quart bowl and add olive oil. Toss well to coat. Spread the shoestring pieces in a single layer on your drying trays. Sprinkle with salt.

3 Set the temperature on your dehydrator to 120 degrees and dehydrate the shoestring potatoes until they're crispy, at least 12 hours. Rotate the trays occasionally to facilitate even drying.

4 Store (if you can!) in a cool, dry place.

VARY IT! For a slightly different flavor, add an additional seasoning you like at Step 2.

PER SERVING: *Calories 50 (From fat 16); Fat 2g (Saturated 0g); Cholesterol 0mg; Sodium 291mg; Carbohydrates 8g (Dietary fiber 1g); Protein 1g*

Zucchini Chips

PREP: 10 MIN	MARINATING: 15 MIN	DRYING: 12 HR	YIELD: 4 SERVINGS

INGREDIENTS

1 pound zucchini (about 3 medium)

¼ cup Italian-style salad dressing

1. Wash and slice the zucchini into ⅛-inch thin slices. Place the slices in a large bowl or gallon-size plastic, sealable storage bag. Pour the Italian-style dressing over the slices and toss to coat. Marinate the zucchini in the dressing for 15 minutes. Place marinated slices in a single layer on your drying trays.
2. Set the temperature on your dehydrator to 120 degrees and dry the zucchini slices for 12 hours (or until crisp), turning at least once. Rotate the trays occasionally to facilitate even drying.
3. Store the zucchini chips for up to three months in a 1-gallon, sealable plastic storage bag.

NOTE: After you open the bag, use the chips as quickly as possible, before they absorb moisture and become soft.

PER SERVING: *Calories 91 (From fat 66); Fat 7g (Saturated 1g); Cholesterol 0mg; Sodium 118mg; Carbohydrates 6g (Dietary fiber 2g); Protein 11g.*

DIYing the Drying of Herbs

Drying herbs is a wonderful way to be sure you have the freshest seasoning possible for your cooking. Because you pick herbs throughout the growing season, you can collect the finest herbs again and again, drying them as you go. Drying herbs is also an easy way to create your own signature blends for cooking and herbal tea. You will always have your favorites on hand if you dry them yourself.

The best herbs for drying are those that are *resinous*, or contain the most oils. The oils are where the scents and flavor come from. Herbs that have very juicy stems and overly thick leaves don't dry well.

Harvest your herbs just after the morning dew has dried, but before the hot, noonday sun has hit them. The heat from the sun drives the fragrant oils out of the leaves and blossoms, so the herbs have less flavor.

TIP

If you find that your herb of choice seems to become tasteless or dries to a black mess, try freezing that herb instead. Two herbs that are commonly used in cooking but do not dry well are chives and basil. Some have luck drying basil at a low temperature, but we don't recommend it for those just starting out. Blend in a little olive oil with these too fussy herbs and freeze instead (go to Chapter 5 of this minibook for details).

TIP

You can use either an oven or a dehydrator set between 115 and 125 degrees. This temperature is just high enough to heat but not cook the herbs. Don't set the temperature any lower than 115 degrees though, because it takes too long and sometimes allows mildew.

Store your dried herbs in small containers. Glass jars with tight-fitting lids work best. For your herbs to maintain the best flavor during storage, keep them away from heat, light, and your refrigerator.

The following sections outline several herbs that are easy to dry. When selecting your herbs, choose those that you're familiar with first.

Chamomile

Chamomile is a delicate flower that is as lovely as it is useful. Harvesting chamomile, however, is difficult in a major scale, making it loved by home gardeners but expensive as an herb farm crop.

TIP

Chamomile has a lightly fruity taste. Because the taste differs slightly from variety to variety, tasting is the best way to find the right chamomile for your garden.

AIR-DRYING FRESH HERBS

An electric dehydrator and oven aren't your only options when it comes to drying herbs. Air-drying them is an easy alternative. Follow these steps to air-dry herbs and check out the figure as well:

1. **If you're harvesting herbs from a garden, cut the stems, don't pick them, leaving an extra inch or two for tying them in bunches.**

   Harvest the herbs in the morning after any moisture on the leaves has dried.

2. **Rinse your herbs quickly by dipping them in a bowl of cool water and shaking off the excess water.**

   Pat them dry with a paper towel, making sure they're completely dry to prevent mildew.

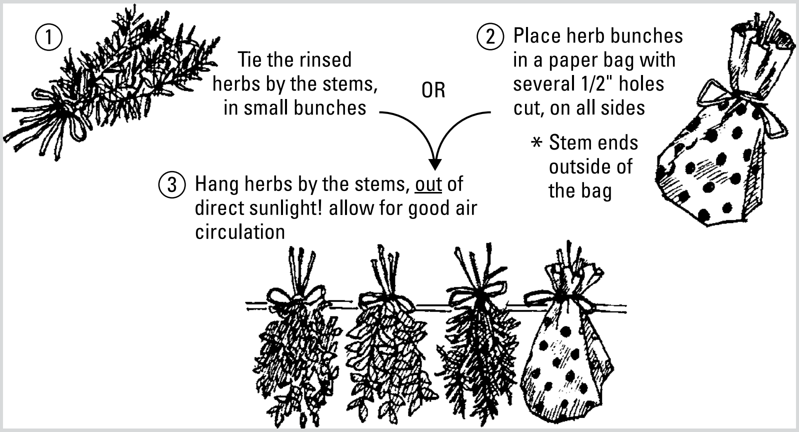
3. **Tie the herb stalks near the cut part of the stem in small bunches (no more than five or six stems) with cotton string or thread.**

   Don't mix your herb bunches because flavors transfer during the drying process.

4. **Either hang the herbs upside down in a warm room (the kitchen works well) near a south-facing window and out of direct sunlight or place the tied herb bundle in a paper bag with holes or slits cut in it for air circulation before hanging the bag in a warm room. Place the herb bundle upside down in the bag with the stems toward the top opening of the bag. Tie the top of the bag closed. The bag protects the herbs from light and catches any loose seeds for replanting your herbs.**

   Your herbs will dry in two to three weeks with good air circulation.

Herbs are dry when they crumble easily. Remove the leaves from the stems. Crush soft leaves (such as basil, sage, and oregano) by hand. Store harder leaves (such as rosemary, tarragon, and thyme) whole, crushing them with a rolling pin before using them.


①
Tie the rinsed herbs by the stems, in small bunches
OR
② Place herb bunches in a paper bag with several 1/2" holes cut, on all sides
* Stem ends outside of the bag
③ Hang herbs by the stems, out of direct sunlight! allow for good air circulation

To harvest chamomile for drying, pick the individual chamomile flowers as they bloom and just after the dew has dried in the morning. This is very important because chamomile's delicate scent is easily lost if you're not careful. Some leaves are fine to include because they also have some chamomile flavor.

To dry chamomile, follow these steps:

1. **Lay the flowers in a single layer on trays.**
2. **Set your oven or dehydrator temperature to between 115 and 125 degrees and dry for 3 to 5 hours, checking carefully after 4 hours and rotating the trays periodically to facilitate even drying.**

   You don't want to overdry them. Flowers are fully dry when the tiny petals curl inward, and the center of the blossom is totally dry.
3. **Store in an airtight container, out of sunlight.**

To use your dried chamomile, pour 1 cup of boiling water over 1 tablespoon dried flowers; then cover and steep for 3 minutes. (Don't steep chamomile too long; it can produce a bitter taste.)

Dill

Dill, an herb that grows anywhere, has tiny leaves and a large, flowering seed head. Harvest the leaves any time you want. Use dill leaves in dressings and pickle mixes. It makes a refreshing dip for vegetables and tastes great added to your summer salads.

TIP

Dill can quickly become an invasive plant. Once the plant goes to seed, it starts popping up everywhere. Be sure to keep it in check by trimming off the flowers and seeds before the plant makes itself a permanent member of your garden.

Drying dill is super easy. Follow these steps:

1. **Lay the dill leaves in a single, loose layer on trays.**
2. **Set your oven or dehydrator temperature to between 100 and 115 degrees and dry 3 to 5 hours, rotating the trays periodically to facilitate even drying.**

   Properly dried dill leaves are crispy.
3. **Store dried dill in airtight containers, out of light.**

   This herb loses its delicate flavor quickly if left in sunlight for too long.

TIP

Chewing a few dill seeds can help with indigestion. Historically, dill was an ingredient in gripe water for colicky infants.

Mint

Mint is arguably the herb most people are familiar with and also the easiest herb to grow. It requires only sunlight and water to thrive. Yes, you can grow mint on a counter in a glass of water — forever!

Mint comes in dozens of flavors, with more being created all the time. From citrus to chocolate, mints are available for any palate. Grow as many varieties as you want, but keep them contained! And harvest them often, throughout the growing season, for drying.

TIP

Mint is a highly invasive herb and will overtake a garden within one growing season if left to spread on its own. Plant mint in a container to keep from having it go wild (literally). If you grow more than one variety of mint, plant them at least 10 feet apart to avoid cross-pollination. Although you will still get mint, it will no longer be true to the original scent you planted, if cross-pollinated.

To dry mint, follow these steps:

1. **Cut the stems that seem to want to straggle, and lay them on a drying tray.**
2. **Set your dehydrator or oven temperature to between 115 and 125 degrees and dry for 3 to 5 hours, rotating the trays periodically to facilitate even drying.**

   Properly dried mint leaves easily crumble in your hand.
3. **Store mint in airtight containers.**

TIP

Try making it into tea or adding a few leaves, crumbled, to boiled potatoes.

Oregano

Oregano is another easy-to-dry herb. Used in any tomato-based dish, oregano adds a distinct flavor to your meals. By drying oregano, you ensure that you have plenty of this popular flavoring available throughout the winter months. Use only young leaves, as older oregano has a tendency to taste bitter.

To dry oregano, pick the young leaves once the dew has dried in the morning and then follow these steps:

1. **Remove any leaves that have insect damage or have been crushed while harvesting.**

   These sometimes turn an unappealing black when drying.

2. **Arrange in a single layer on trays, but don't fill them too full. You want air to flow around them.**
3. **Set the temperature on your dehydrator to between 115 and 125 degrees and dry the oregano for 3 to 5 hours, rotating the trays periodically to facilitate even drying.**

   Properly dried oregano is dry and crumbly.

4. **Store dried oregano in its whole form until ready to use.**

To use dried oregano, crush the leaves in your hand just before adding to the dish. Add oregano to the dish in the last 10 minutes of cooking to preserve the flavor.

Rosemary

Rosemary is a centerpiece to any herb garden. Its scent is recognizable by nearly everyone, and its lovely bluish flowers are truly special. Rosemary can be harvested throughout the season. To dry, cut the smaller, side stems where they branch off from the main stem and then follow these steps:

1. **Lay the whole stems onto the drying trays.**
2. **Dry the herb for 6 to 8 hours at a temperature between 110 and 115 degrees, rotating the trays periodically to facilitate even drying.**

   They're done when the leaves slightly shrivel and release from the stem easily.

3. **Remove the leaves by holding the stem over a dish or container and running your fingers along the stem.**

   The leaves come off with a gentle touch and you are left with a clean stem.

4. **Store rosemary leaves whole, and break them up right before adding to your recipe.**

   This keeps most of the flavor inside until needed.

TIP

Save the dried rosemary stems for making kabobs. They contain plenty of the rosemary flavor, and make a unique presentation. Use the stems as you would skewers.

Sage

Sage is an easy-to-grow herb that is available as seeds or plants that quickly grow into small, lovely bushes. You can use any variety of garden sage for drying. Some offer a stronger flavor than others, so be sure to taste it before purchasing to find your favorite. To dry sage leaves, harvest them as they become large enough (½ inch or more in length) and then follow these steps:

1. **Lay out your sage leaves in a single layer on your drying trays.**

   Be sure to leave room between the leaves for even drying.

2. **Dry the herb for 6 to 8 hours at a temperature between 115 and 125 degrees, rotating the trays periodically to facilitate even drying.**

   It's dry enough if a leaf crumbles in your fingers.

   REMEMBER

   Be careful to dry these leaves thoroughly; they are slightly thicker than many other herbs and require careful attention.

3. **Store the dried leaves in their whole form until needed.**

   TIP

   If you find that you use rubbed sage often, dry the whole leaves and rub them through a mesh strainer to create a fluffy sage powder perfect for cooking.

Thyme

Thyme has many uses: It tastes great mixed with other herbs for flavoring Italian dishes and it can hold its own when paired with poultry. Thyme comes in many varieties, but the drying technique is the same. Follow these steps:

1. **Snip off stems as soon as your plants are large enough for drying and lay them whole, in a single layer, on your drying tray.**

2. **Set your oven or dehydrator temperature to between 110 to 115 degrees and dry the thyme for 4 to 6 hours, rotating the trays periodically to facilitate even drying.**

   Properly dried thyme leaves are dry and crisp.

3. **Store dried thyme, stems and all, in a cool, dry place away from sunlight.**

   Thyme loses its flavor quickly when left in sunlight.

When it comes time to use your dried thyme, crush the tiny stems right along with the leaves. If stems are too woody, strip leaves off, right before use.

TIP

The next time you have a cough or cold, make a tea out of dried thyme leaves. Thyme tea tastes very soothing when you are congested.

IN THIS CHAPTER

- **Creating root cellar storage ranging from traditional to found spaces**
- **Knowing how to prepare various fruits and vegetables for storing**

Chapter 7

Root Cellaring and Storage

An often overlooked storage idea is underground storage. The traditional root cellar is an efficient way to keep many foods fresh throughout the winter months. Keeping your harvest at its best through cold storage is easier than you think! If you're not lucky enough to have a place for a root cellar, you can keep food at the proper temperature in all sorts of other creative ways.

In this chapter, you discover creative ways to store your produce and find out how to select the best foods to keep in cold storage.

Finding the Perfect Place for Cold Storage

Before refrigeration and artificial preservatives, cold storage was the way to go if you needed to store produce over the winter. The basic idea behind cold storage is that you can prolong the shelf life of both fresh and canned produce by keeping them in a cool, dark place under just the right conditions.

By combining the perfect mix of temperature and humidity, you can expand your storage to a large variety of foods. Temperature and humidity aren't the only considerations, however. An area used for cold storage also needs to have proper ventilation to keep the food as fresh as possible. And ease of access is vital, too.

- **Temperature:** Cold storage temperatures range from 32 to 60 degrees. The right temperature for any given food is one that slows the enzymes responsible for decay. Different foods require different storage temperatures. Beets, for example, need temps just above freezing; pumpkins and squashes, on the other hand, need temps in the 50- to 60- degree range.
- **Humidity:** Depending on the foods you want to store, your root cellar or alternative cold storage area needs a humidity range from 60 to 95 percent. Foods such as carrots, parsnips, and turnips store best at 90 to 95 percent humidity. Sweet potatoes and onions, on the other hand, do much better at a humidity of no more than 70 percent.

  REMEMBER

  If you plan to store foods that require very different humidity and temperature levels, you need to use more than one storage area. It's not uncommon to have a dry cold storage area with lower humidity (like you'd get in an area that has a cement floor) and a higher humidity area (which you get in an area with a dirt or gravel floor).

  To keep track of temperature and humidity level in the air, buy a simple thermometer unit, called a *hydrometer* (see Figure 7-1).
- **Ventilation:** No matter what type of storage area you choose, it must be able to let warm air out and cool air in.
- **Ease of access:** Because you have to regularly check your stored food, you need a place that is easy to get into and that allows you to easily move things around.

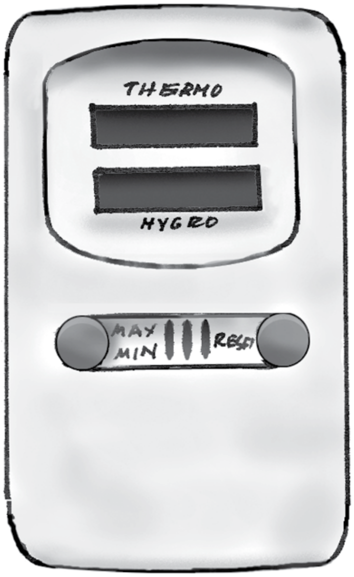


FIGURE 7-1: A hydrometer for checking temperature and humidity.

Read on to find out what your cold-storage options are, and head to the section "Preparing Foods for Cold Storage" to discover the optimum humidity levels and temperatures required for specific foods.

Tried and true: The traditional root cellar

Root cellars have had a long and important place in the history of food storage. Root cellars were most often the actual cellar of old homes and farmhouses. These older houses had cellars with dirt floors, perfect for keeping foods cool and the humidity higher than average.

If you're lucky enough to have a dirt-floor root cellar, you just need to provide sturdy shelving and rodent-proof the area by covering any holes or potential rodent-friendly entryways with wire mesh. You can also place rodent bait in out-of-the-way areas and check often for rodent activity.

TIP

A preexisting root cellar usually contains some sort of air vent or pipe located at the top of the area to allow warm air to rise and escape. If you don't have a preexisting air vent, periodically open a window or door to the outside to allow warm air out and fresh air in.

REMEMBER

In modern homes, cellars (or basements) often have concrete floors and are generally too warm and dry for food storage. Carefully measure your temperature and moisture content before placing your produce in a cellar that may not have optimum conditions.

DIY storage spaces

If you don't have a cellar with a dirt floor, there are alternatives. Take a look at your cellar layout and consider the areas suggested in the following sections.

Stairwells

Does a stairwell lead from your basement to the outside? If so, add an insulated door to separate the stairwell from the main room, and voilá, you have a cold storage space that has built-in shelves: the stairs! Just place bins of produce on each step and pans of water under the stairs for moisture, and you have an efficient storage area, as shown in Figure 7-2.

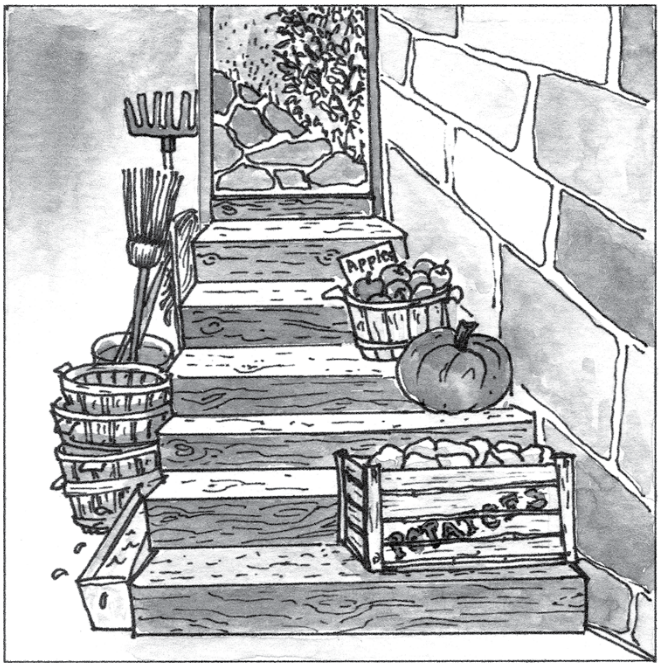


FIGURE 7-2: A stairwell converted into a cold storage area.

REMEMBER

A stairwell is particularly good because the stairs create areas with varying temperatures, allowing for a wide array of conditions that can benefit many different kinds of foods.

Be sure to place a hydrometer in this area, as well as a few, inexpensive thermometers on different steps, to gauge the best conditions for your stored foods. There will be quite a variation in temperature as you go up the stairs.

Storm shelters

Do you have a storm shelter (also called a storm cellar)? In the Midwest, storm shelters are often underground cellars separate from the house or basement. (Think of Dorothy in *The Wizard of Oz,* when she runs through the yard to get to the storm cellar during the tornado.) These shelters are perfect for adding some shelves and neat bins of produce. They're below the frost line, have adequate ventilation, and are weatherproof. Whether your home had a storm shelter when you moved in or you decided to build one yourself, be certain to block any ventilation pipes with fine screen to keep out rodent activity.

TIP

Your stored foods will be used up long before the storm season approaches. Even so, keep your cold storage organized and neat.

Straw-bale storage

If you have a small area in your yard, you can construct a simple straw-bale storage area (see Figure 7-3) to hold your root crops, such as potatoes, rutabagas, turnips, and parsnips.

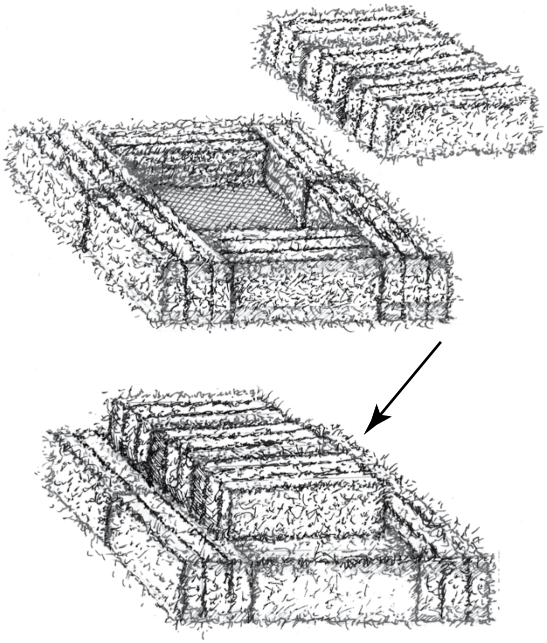


FIGURE 7-3: Straw-bale storage.

The best location for straw-bale storage is one that tends to stay dry. Don't place these storage areas in high moisture areas (where you generally have a buildup of snowdrift, for example, or where water tends to puddle after storms). Also, don't build one close to buildings that protect the area from winter temperatures. You want the straw bales to be able to stay freezing cold on the outside and yet insulate the produce inside.

After you've found a suitable location, follow these steps to build your storage area:

1. **Place two bales of straw in a line, with the ends touching. About 16 inches away, place two more bales parallel to the first two.**

   The spacing is adequate for the bales that are laid on top to cover the open space completely.

2. **Place one straw bale on each of the remaining ends to enclose a box shape in the center.**

   You've just made a large square in the center.

3. **Cover the ground in the center of the square with a screen.**

   You don't have use the screen, but doing so helps keep your produce protected from critters that may be inclined to dig under the whole thing.

4. **Layer some soft straw on the bottom of the square to cushion the produce.**

   If you put a screen in the center, place the straw over the screen.

5. **Layer your root crops, very gently, into the bin.**

   REMEMBER

   Take care to not dump or toss your vegetables. Bruised food quickly turns to spoiled food.

6. **When the bin is full, layer another couple of inches of straw onto the food.**

7. **Place bales of straw across the top of the now-filled bin.**

   Your food is now protected from winter in a breathable storage bin.

To check on or access the food inside, simply remove the top two bales. Replace the bales carefully and evenly to cover the hole each time. In the late spring, or when the straw-bale storage area is empty, simply take the bin apart, and use the straw as mulch for your garden.

WARNING

Some people use hay bales for these storage bins, but we don't recommend it. Hay molds rather quickly, sometimes spoiling the produce inside. Hay bales also seem to absorb more moisture than straw bales. If you use hay, check periodically for moisture damage, and remove the offending produce immediately.

Rubber trash cans

You can bury these up to their rims in the ground, place your produce inside, put on the lid, and then cover the whole thing with a thick layer of straw for a simple cold storage arrangement. These bins are easy to wash and the tight lids keep the foods fresh and sanitary and keep rodents out.

Following Simple Storage Rules

Underground storage is the fastest and possibly easiest way to store foods. There are, however, some rules to follow, no matter what variety of food you want to keep over the winter:

- **Be careful about the quality of the food you store:** Foods must be in perfect condition — not too ripe or picked too early. Overly ripe fruit is extremely fragile and in the last stage before naturally decaying. Food that's too green doesn't do particularly well, either. These foods may change color or become agreeably soft in storage, but they won't truly ripen and develop their best flavor in these conditions.

  Make sure you pick your food at just the right ripeness, as fresh as possible, and store it immediately. *Don't* allow it to sit at room temperature while you decide what you are going to do with it.

- **Be careful about how you pair foods:** Some foods produce gases that make other foods spoil. For instance, apples produce a gas that makes potatoes start to sprout. Put these two together, and you'll end up with potatoes that are soft and inedible. Cabbage is a very strongly scented food that is better stored in an outside area, away from more delicately flavored items.

- **You must care for the foods, even while in storage:** Weekly checking for bruising, decay, dryness, and mold is essential. The old adage about a rotten apple spoiling the barrel definitely applies here. As the winter progresses, remove any produce that has blemishes. Your remaining foods will continue to last longer.

  TIP

  Rearrange your produce carefully. You may discover that you've used enough of your stored produce to enable you to bring the bottom layer up to the top. Be careful of excess handling though; gently place each food back in place to avoid bruising.

- **Choose the right storage container:** Choose containers that let you keep things neat and very organized. Some ideas:

  - **Rubbermaid-style tubs:** These can be stacked when not in use, their covers fit tightly, and they can easily be filled with damp sand for foods needing increased humidity. Use clear bins to avoid colors leaching into foods and so that you can easily see all the produce inside.

  - **Wooden bins or boxes:** Recycle these from thrift stores and some grocery stores. Even if you have to pay a few dollars each, they will give years of service and allow for neat, tidy stacking. If stacking wooden boxes, place the first row in a line, place a couple of sticks across the boxes for air circulation, and then place the next boxes. You want to let the moisture and gases escape, which allows the food to last longer.

  - **Five-gallon pails:** You can find these for next to nothing from bakers and other restaurants. You don't need to include the lid; in fact, for cold storage, it is best not to. Fill the clean, dry bucket with produce, layer a damp cloth on the top and you can stack these buckets in a pyramid shape, allowing plenty of airflow between.

- **Old dressers:** You can arrange these unconventional pieces against a wall and use the drawers to keep your produce in a dry and safe place. Line the drawers with newspaper for easy cleaning. Keep them slightly ajar for proper air circulation.

Preparing Foods for Cold Storage

Foods that store well are generally the less juicy and delicate things, such as root vegetables and firm fruits. The following sections list several fruits and vegetables that keep very well in cold storage. They are foods that many families enjoy; they provide a fresh taste when bland winter fare abounds; and they extend your food pantry to include fresh, tasty choices. (***Note:*** You may be able to extend the life of more tender foods, such as eggplant or broccoli, but don't count on them lasting for months as the other foods will. You can keep these treats in storage about two weeks, but no longer.)

TIP

As a general rule, harvest root crops as late as you can in the season and don't wash the dirt from the roots. Simply use your hand or a rag to remove some of the loose soil.

Apples

Apples store very well. Choose a variety that is known for storage. Kept well, apples can last throughout the entire winter — four to six months! Toward the end of that time, a perfectly good apple may become slightly shriveled. This is simply from the loss of moisture, not nutrition.

Choose apples that are unblemished and firm (they shouldn't give at all when pressed). Check in bright light for dents and soft spots.

To store, layer the apples carefully in very cold temperatures (between 30 and 35 degrees), with a high humidity between 80 and 90 percent. (Place a pan of water in the area where they're stored.)

TIP

Try covering your bin of apples with a damp (not dripping) cloth, which remains damp for at least a day. And make it a habit to replace the cloth every couple of days when you check other stored produce.

Beets

Beets are prolific and inexpensive to grow, meaning you'll end up with plenty for storage if you plant a few rows. Harvest beets late in the season, after the nights become freezing cold. If you're buying beets at a farmer's market, look for fresh, crisp tops. This is the best indication that the beets are just picked.

To prepare the beets for storage, cut off the tops, leaving the beet itself intact (don't wash them). Then place the beets in your coldest storage, temperatures just above freezing, 32 to 40 degrees, with 90 to 95 percent humidity. To increase humidity naturally, place the beets on moist sand.

Some gardeners recommend leaving beets in the ground, covered with a thick layer of straw. They say beets and other root crops can be harvested directly from the ground into the coldest part of the winter. Be aware, though, that rodents may destroy root crops before you get a chance to harvest them. So before you follow the advice of the "leave 'em in the ground" crowd, make sure you — and not rodents — will be the benefactors.

Cabbage

Cabbage adds bulk and crunch to many winter dishes. Keeping cabbage in storage requires a few extra precautions, however, to ensure that it remains useable throughout the winter and doesn't ruin other food nearby.

First, cabbage gives off a strong odor while in storage, which is normal (don't confuse this smell with spoilage). The problem with the smell is that apples and other fruits can absorb the flavor of cabbage. The key is to make sure you don't store cabbage too closely to these other types of foods. If you must store cabbage close to other foods, wrap individual heads with newspaper to contain the odor.

TIP

The longer cabbage remains in storage, the stronger the taste when it's cooked. If your family does not like the stronger taste, plan on using up cabbage early in the storage season.

Second, cabbage needs to be stored in a damp area. If you store cabbage in a place that's too dry, the heads dry out, and the dry, wilted leaves are wasted. Fortunately, you can take care of this tendency with a simple pan of water.

To prepare cabbage for storage, choose unblemished cabbage that has not been picked for long. Remove the tough outer leaves. Wrap each head in newspaper and store it where temperatures are just above freezing, 32 to 40 degrees, and the humidity levels are between 80 to 90 percent. Place a pan of water near the cabbage to provide enough moisture during storage.

Carrots

Carrots are another root vegetable that stores well and tastes sweet and crisp throughout the winter months. Just as you do with beets, pick carrots as late as possible in the season. Avoid any that have grown too large and pithy, however, because these carrots have used up their natural sweetness and will taste bitter.

To prepare carrots for storage, trim off the tops, leaving the carrot itself intact. Don't wash them; simply brush off excess soil if you want to. Place carrots with beets in coldest storage of 32 to 40 degrees with high humidity of 90 to 95 percent. Carrots do especially well in moist sand.

Garlic

You can never have enough garlic, especially since garlic is so easy to store. If you're growing your own garlic, simply pull the bulbs after the tops have dried and fallen over. Allow the garlic bulbs to dry thoroughly out of direct sunlight until the outside of the bulbs has become dry and papery. Purchased garlic bulbs have already been dried. Look for the papery outer layer that you always see on a store-bought bulb.

Dry bulbs on newspaper outside during the warm summer days, but bring them in during the cool nights to prevent condensation. Repeat this process for a few days, until the garlic is completely dry.

When the garlic is thoroughly dry, tie bunches of tops together, braid in attractive garlic braids. Alternatively, you can trim tops from bulbs and place them in women's stockings, tying a knot between bulbs. You can hang this long chain of bulbs on a nail in a cool and slightly damp area. You may have luck placing garlic in a cool coat room, instead of an actual root cellar. They are in a convenient location for cooking, and let's face it, they make quite a conversation piece! If you do keep them in cold storage, place them in 30 to 45 degrees with a humidity level of 60 to 70 percent.

Onions

Most onions keep very well in cold storage. Some varieties, such as the extra sweet onions, however, don't last long. When planting, choose varieties that say they work well for storage (you'll see the term *good keeper*). These onions last throughout the storage season.

Harvest onions the same as garlic. Pull them when the tops turn brown and fall over. They must then be cured, like garlic: Place them on newspaper to dry during the warm days, bringing them in during the cool night hours to avoid condensation buildup. When storing purchased onions, you don't have to worry about this step. They are already dried for you.

To store, gently place onions in a crate, loose mesh bag, or ladies' stockings, tying a knot between each onion. To prevent mildew on onion skins, air circulation is vital, so make sure your cold storage has adequate ventilation (see the earlier section "Finding the Perfect Place for Cold Storage"). The ideal storage conditions are temperatures of 35 to 40 degrees and humidity of 60 to 70 percent. If, throughout the season, you find onions with some mildew on them, simply use those onions first. Generally the mildew is on the outer layers, leaving the inside onions fresh.

Pears

Pears store very well and make a nice change from apples. In years when apples are affected by blight or scald and are too expensive, pears can be more available.

Pick pears you plan to store when they're just ripened. (Don't choose pears that are too ripe, or soft; simply leaning against each other can cause them to bruise.) To help protect the fruit, wrap each pear in a sheet of newspaper before storing. Keep temperatures cold, 30 to 35 degrees, with high humidity (80 to 90 percent). Pears can keep for several months in this manner.

Potatoes

Potatoes are the easiest of all fruits and vegetables to store. To prepare for storage, harvest late in the season. Don't wash the potatoes; instead remove excess soil with your hand or a soft rag. Inspect them carefully for bruising or nicks in the skin (fresh potatoes have a more delicate skin than those that have been harvested for a few days). If you find any bruising or nicks, keep these potatoes out of storage and use them within a few days.

Store potatoes in complete darkness at 32 to 40 degrees and 80 to 90 percent humidity. Every week, check them for damage. At least once a month, turn and rearrange them. Finally, don't let them freeze. A frozen potato is a ruined potato; it can't be saved.

REMEMBER

The most important rule for storing potatoes is to store them in complete darkness. First, the darkness signals dormancy for the potato, and it won't sprout. Second, potatoes subjected to light become bitter over time. Other than perfect darkness, potatoes really do well in almost all storage conditions.

Turnips

Turnips are an underappreciated root crop. They are easy to grow: You simply plant them early in the season, weed them a few times, and harvest them late in the season, after the nights become freezing cold, sometime in November.

To prepare turnips for storage, don't wash them. Simply brush off any excess soil with your hand or a rag, and trim off the turnip tops.

Store them in your coldest storage area; just above freezing is ideal (temperatures of 30 to 40 degrees). The humidity should be high; between 90 to 95 percent is optimal. Turnips are another food that stores well in damp sand.

TIP

Consider turnips a crop that provides two separate foods: the greens and the root. So, after you trim the tops to prepare the root for cold storage, don't throw away the greens. You can dry them for use later. To see how to keep turnip tops, head to Chapter 6 of this minibook for info on drying greens.

Tomatoes

You may be surprised to see tomatoes, which are both fragile and juicy, in this list of good cold-storage vegetables. Tomatoes can, however, be kept for a limited period of time in cold storage.

When you store tomatoes, you store the whole plant, not just the individual tomatoes. So at the end of the growing season, select any tomato plants that have fruit with the slightest hint of ripening (any color change, from slight yellow to orange) and follow these steps:

1. **Remove any fruits from the plant that are still fully green or too small to ever ripen.**
2. **Pull the entire plant out of the ground and hang it upside down in temperatures between 55 and 70 degrees, with moderate humidity of 60 to 70 percent.**

   An unheated garage or cellar stairwell works great for this.

The tomatoes will ripen slowly over time, right on the vine. You will be amazed at the vine-fresh flavor.

3

Making Your Own

Contents at a Glance

CHAPTER 1: **Brewing Beer** 371
Setting Up Shop to Brew 372
Getting to Know Your Ingredients 374
Brewing Your First Batch 377
Taking Hydrometer Readings 380
Bottling Your Brew 383

CHAPTER 2: **Fermenting** 389
Getting Familiar with Fermentation 389
Fermenting Essentials 390
Cleaning, Sanitizing, and Sterilizing 392
Fermenting Vegetables (including Sauerkraut and Kimchi) 393
Starting Sourdough 401
Mooving On to Dairy 405
Raising a Glass to Fermented Beverages 416

CHAPTER 3: **Baking Bread** 425
Understanding Yeast Breads 425
Mixing and Kneading Breads 428
Encouraging Bread to Rise 430
Shaping and Baking the Loaves 431
Yeast Bread, Quick Bread, Muffin, and Biscuit Recipes 432

CHAPTER 4: **Making Candles and Soap** 441
Igniting Your Candlemaking Hobby 442
Rolling Beeswax Candles 444
Making Molded Candles 445
Taking a Dip with Tapers 447
Cleaning Up with Homemade Soap 450

IN THIS CHAPTER

- » Diving in to the ingredients of homebrewed beer
- » Brewing and bottling your first batch

Chapter 1

Brewing Beer

As a homesteader, you're already eating the fruits of your labor that come out of your garden. Why not bring that same do-it-yourself mentality to something you enjoy out of a glass, too? Homebrewed beer can be every bit as good as — if not better than — a lot of commercial beer, with more flavor and character than most. In fact, avoiding mass-market beer was the original inspiration for homebrewing. Since homebrewing became legal almost 30 years ago, the interest in hand-crafted beer has blossomed.

But forget any preconceived notions you may have about shiny copper kettles and coils taking up your whole kitchen and huge wooden vats bubbling and churning in the cellar — those notions are the product of vivid imaginations and vintage Hollywood movies. Human civilization is well into the stainless-steel and plastic age, where everything is smaller, more durable, and lighter.

You can brew your own beer with minimal equipment — readily available in simple kit form — and a short time commitment. A batch of beer is about a three-week process (on the short end), but that includes only four to six hours of work; the rest is waiting as you let the beer do its thing.

Adding some homebrewing efforts to your homestead will be pretty painless — and with a tasty, frothy reward waiting for you at the end!

Setting Up Shop to Brew

To the first-timer, the vast quantities of equipment and ingredient choices related to homebrewing can be somewhat intimidating. Homebrewing equipment varies, as shown in Figure 1-1, but any homebrew supply shop worth its salt can get you what you need to get started. If you don't have a local homebrew supply retailer in your area, mail order is the next best option. Many mail-order shops have toll-free phone numbers or websites for ordering, and most offer free catalogs.

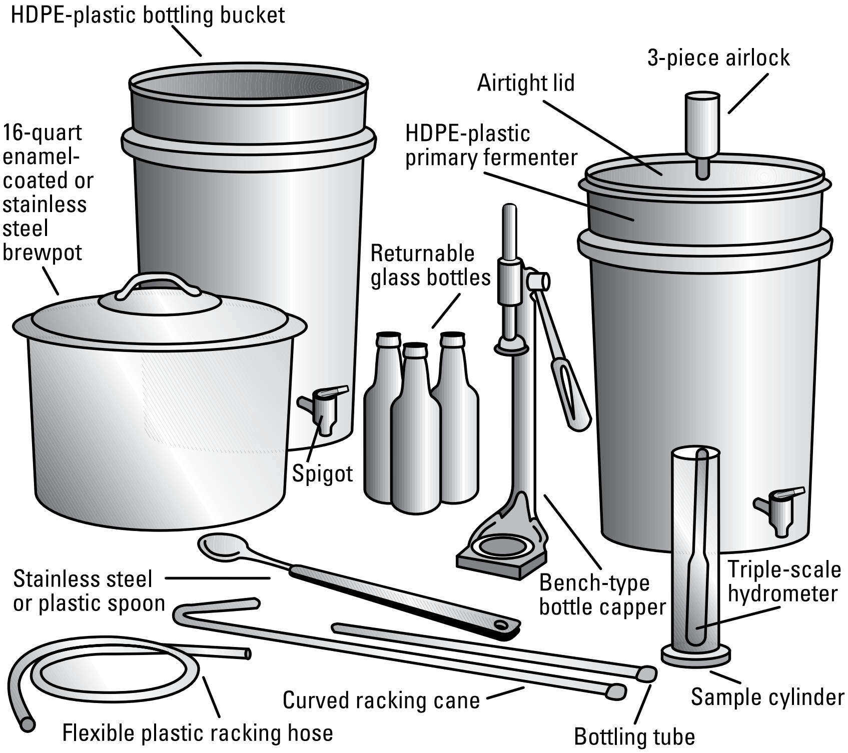

HDPE-plastic bottling bucket
3-piece airlock
Airtight lid
16-quart enamel-coated or stainless steel brewpot
HDPE-plastic primary fermenter
Returnable glass bottles
Spigot
Stainless steel or plastic spoon
Bench-type bottle capper
Triple-scale hydrometer
Curved racking cane
Sample cylinder
Flexible plastic racking hose
Bottling tube

FIGURE 1-1: Many homebrew shops sell this basic equipment as a start-up kit.

At the beginner level, the minimum amount of equipment you need to brew beer correctly will cost about $70. This setup is relatively bare-bones, but it's enough to get you up and running. As you become more familiar and comfortable with the processes and procedures, you'll want to acquire additional and better equipment.

To help you get the wheels turning, Table 1-1 provides a starter list of necessary items and their approximate costs.

TABLE 1-1 Beginner Brewing Equipment and Its Cost

Equipment	Approximate Cost
Brew pot, 16 qt. minimum	$40/20 qt., $80/30 qt.
Brew spoon (HDPE plastic)	$4 or less
Primary fermenter (HDPE plastic) with spigot, lid	$20 or less
Airlock	$2 or less
Drilled rubber stopper for airlock	$2 or less
3 to 4 feet of food-grade plastic hose, ½ inch in diameter	$3
Bottling or "priming" bucket (HDPE plastic) with spigot	$15 or less
Bottles (must be the reusable type that don't use twist-off caps)	$20–$30 for one batch of beer (5 gallons); the exact number of bottles depends on their size: 12 oz., 16 oz., 22 oz., or 1 qt.
Bottle rinser	$12
Bottle brush	$3
Bottling tube (HDPE plastic) with spring valve	$4 or less
Bottle capper	$35 (bench-type) or $15 (two-handed)
Hydrometer (triple scale) with cylinder	$10 ($5 or less for the cylinder)

HOW MUCH DOES A HOMEBREWED BATCH COST?

The average batch of homebrewed beer is 5 gallons, or 53.3 12-ounce bottles of beer. At the beginner level, the ingredients for a typical batch run about $30 to $35. The amount you pay fluctuates because of many factors, including where you shop for your ingredients (don't forget shipping charges for mail order), whether you buy top- or bottom-of-the-line ingredients, and the style of beer you like to brew. Big-bodied, alcoholic beers require more fermentable ingredients than do light-bodied, watery beers. (Barley wines can cost as much as 100 percent more to make than pale ales, for example.)

Getting to Know Your Ingredients

Brewing uses grain (mostly malted barley), hops, yeast, and water. Thanks to many stores and Internet sites that specialize in brew supplies, homebrewers today have access to most of the same ingredients used by corporate brewhouses everywhere. Of course, these shops don't just provide the everyday ingredients for the average beer; different hop varieties and yeast strains from around the world are now available in the homebrewing market.

Grain

Of the four main ingredients used to make beer (barley, hops, yeast, and water), barley — really, grain in general — makes the biggest contribution. It's responsible for giving beer its color, underlying flavor, sweetness, body, head of foam, and *mouthfeel* (the textural qualities of beer on your palate and in your throat — *viscosity*, or thickness, carbonation, alcohol warmth, and so on). Grains also contribute the natural sugars that feed the yeast, which in turn converts the sugars into alcohol and carbon dioxide during fermentation.

Before you can brew with barley, it must undergo a process known as malting. The *malting process*, simply put, simulates the grain's natural germination cycle. Only after the barley has undergone the malting process does it become *malt*, or *barley malt*.

Hops

If malts represent the sugar in beer, hops surely represent the spice. In fact, you use hops in beer in much the same way that you use spices in cooking. The divine mission of hops is to accent the flavor of beer and, most importantly, contrast the sweetness of the malt.

Hops contribute bitterness (to offset the sweet flavor of malt), a zesty flavoring (to accent the malt character), a pungent floral or herbal aroma, bacterial inhibitors, and natural clarifying agents.

The hop cones used in the brewing process grow on vines that may reach 25 feet on commercial hop farms. Hop plants are hardy perennial plants that are prolific under ideal conditions, and each may produce up to 2 pounds of dried hop cones per season.

Traditionally, brewers handpicked hops from the vine and air-dried them in bulk before tossing them whole into the brew kettle. Today, however, hops are processed and sold in four forms: small processed pellets, larger compressed plugs, whole-leaf hops (see Figure 1-2), and concentrated liquid hop extract.

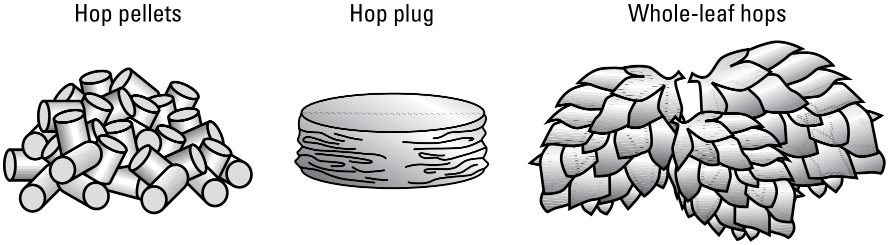


FIGURE 1-2: Some of the different ways that brewers process hops.

Yeast

Although yeast is an ingredient that the average beer consumer rarely contemplates, brewers often consider it the most important ingredient. Yeast can have a greater influence and effect on the finished beer than any other single ingredient.

Yeast is a member of the fungus family. It's a living single-celled organism and one of the simplest forms of life. Because it has cell-splitting capabilities, it's also self-reproducing. Yeast is the one ingredient responsible for carrying out the *fermentation* process in brewing: simply put, the natural conversion of sugar to alcohol. (For much more on fermentation in other homesteading applications, check out Book 3, Chapter 2.)

Brewers categorize and classify beer styles by the type of yeast used to ferment them. Therefore, they choose a yeast according to the style of beer they want to make: ale or lager.

A WORD ABOUT ALCOHOL CONTENT

You can brew beer at home without caring one whit about its alcohol content, but you'd likely be in the small minority. Most homebrewers are keenly interested in knowing how much alcohol is in their brew, whether it's on the high side or the low side. And most make a concentrated effort to target specific alcohol levels in their beer.

That's where a hydrometer comes in. A standard and readily-accessible piece of homebrewing equipment, a *hydrometer* registers alcohol by volume, referred to as ABV in the beer world.

Brewers who want to produce a nonalcoholic beer at home may be disappointed; it's not as easy as just not adding yeast. Unfermented beer is thick, sweet, and not at all thirst-quenching. It takes a lot of specialized equipment and technology to produce and necessitates extra steps that are generally not worth the effort on a small scale. All things considered, it's cheaper and easier to simply buy nonalcoholic beer at the store.

Ale yeast is a *top-fermenting* strain, meaning it floats on the top of the beer. Virtually all ale yeast works best in fairly warm temperatures (60 to 70 degrees Fahrenheit). *Lager yeast* is a *bottom-fermenting* strain (meaning it sinks to the bottom of the fermentation vessel at the end of fermentation) and works best between 38 to 50 degrees Fahrenheit.

Yeast for the homebrewer comes in both a dry form and a liquid form. Because of its convenience, dry yeast — granulated and contained in a small packet — is recommended for beginners. The packets that come with malt extract kits are sufficient to ferment a 5-gallon batch of homebrew. Dry yeast is freeze-dried, so it should last a long time (but refrigerate all yeast to maintain optimum freshness).

TIP

For the best results with dry yeast, always rehydrate the dormant cells by pouring them into a cup of warm water. This gentle wake-up call prepares the yeast for the upcoming fermentation. Be sure to sanitize the vessel in which you rehydrate the yeast.

Water

Considering that it constitutes up to 95 percent of a beer's total ingredient profile, water can have a tremendous influence on the finished product. The various minerals and salts found in water used for brewing can accentuate beer flavors or contribute undesirable flavor components. In many cases, water chemistry is key in the flavor profile of a classic beer style.

That said, you can still make good beer with average tap water. Thousands of homebrewers are proving it every day. A general rule says, "If your water tastes good, so will your beer".

REMEMBER

At any skill level, make sure that you keep the following things in mind:

- If your water is from a private underground well, it may be high in iron and other minerals that may affect your beer's taste.
- If your water is softened, it may be high in sodium.
- If your water is supplied by a municipal water department, it may have a high chlorine content. Other than chlorine, the *filtering* (the primary method of removing elements and impurities from water) performed at municipal water sources usually produces water that is sufficiently pure for brewing.

EXTRA, EXTRA! ADJUNCTS AND FLAVORINGS

Grain, hops, yeast, and water are the four primary ingredients in beer, but they don't have to be the only ingredients you use. Anyone paying even the slightest bit of attention to the current beer market knows that brewers now put a lot of unusual ingredients into their beers.

Adjuncts (any fermentable ingredients other than malted grains) are used with the express intent of contributing fermentable sugars, but they can also add flavor. Flavorings are used with the express intent of adding flavors, but they may also add fermentable sugars.

You won't find any hard-and-fast rules about how to use adjuncts and flavorings in your brews — you're limited by only your imagination. Homesteaders may find themselves experimenting with adjuncts such as honey from their backyard beehive (see Book 4, Chapters 1 and 2) or homegrown flavorings ranging from blueberries to ginger root to basil, oregano, and rosemary.

Be bold, be brave, be intrepid, and be ready to drink two cases of whatever it is you dream up!

High iron, sodium, and chlorine contents in your brewing water are not desirable. If these minerals are present in your brewing water, you may want to consider buying bottled water for your brewing needs.

WARNING

If you choose to buy your water, you may be tempted to buy *distilled* water because it's the purest form available. But distilled water is also devoid of some of the important natural elements beneficial to beer.

Brewing Your First Batch

Enough of the preliminary stuff. It's time to get brewing! This section walks you through the step-by-step process of brewing at home. Just follow along and you can make great beer in no time.

The following numbered list covers 24 steps that walk you all the way through the brewing process. Twenty-four steps may sound intense, but rest assured they're easy, quick, and painless (unless you consider turning on a burner to be exhausting work). Besides, when you're done, you've brewed your first beer!

1. **Fill your brew pot about ⅔ full with clean tap water or bottled water and then place it on the largest burner of your stove.**

   Use bottled water if your home's water source is loaded with chlorine, iron, or high concentrations of other trace metals.

   TIP

   The exact volume of water isn't terribly important during this step, because you add cold water to the fermenter later to bring the total to 5 gallons.

2. **Set the burner on medium-high.**
3. **Remove the plastic lids from the kits and set the yeast packets aside.**
4. **Strip the paper labels off the two cans of extract and place the cans in a smaller pot or saucepan filled halfway with tap water. Place the pot or saucepan on another burner near the brew pot.**

   The water's purity isn't important here because you don't use this water in the beer.

5. **Set the second burner on medium.**
6. **Using hot pads, flip the cans in the warming water every couple of minutes.**
7. **As the water in the brew pot begins to boil, turn off the burner under the smaller pot (containing the cans), remove the cans from the water, and remove the lids from the cans.**
8. **Using a long-handled spoon or rubber spatula, scrape as much of the warmed extract as possible from the cans into the water in the brew pot.**
9. **Immediately stir the extract/water solution and continue to stir until the extract completely dissolves in the water.**

   This malt extract/water mixture is now officially called *wort* in brewer-speak.

   WARNING

   If you don't stir the wort immediately, you risk scorching the extract on the bottom of the brew pot.

10. **Top off the brew pot with more clean tap or bottled water, keeping your water level a reasonable distance — about 2 inches — from the top of the pot to avoid boil overs.**
11. **Bring the wort to a boil (turn up the burner if necessary).**

12. **Boil the wort for about an hour, stirring the pot every couple of minutes to avoid scorching and boil overs.**

    WARNING

    Never put the lid on the brew pot during the boiling phase! Stove-top boil overs occur regularly when a brew pot's lid is on. Boil overs are not only a sticky, gooey mess but also a waste of good beer!

13. **Turn off the burner and place the lid on the brew pot.**
14. **Put a stopper in the nearest sink drain, put the covered brew pot in the sink, and fill the sink with very cold water.**

    Fill the sink completely (or up to the liquid level in the brew pot if the sink is deeper than the brew pot).

15. **After 5 minutes, drain the sink and refill it with very cold water — repeat as many times as needed until the brew pot is cool to the touch.**
16. **While the brew pot is cooling in the sink, draw at least 6 ounces of lukewarm tap water into a sanitized cup or bowl.**
17. **Open the yeast packets and pour the dried yeast into the cup or bowl of water.**

    Called *proofing,* this process is a gentle but effective way to wake up the dormant yeast and ready it for the fermentation to follow.

18. **When the brew pot is relatively cool to the touch, remove the brew pot lid and carefully pour the wort into the fermentation bucket.**

    Make sure the spigot is closed!

19. **Top off the fermenter to the 5-gallon mark with cold, clean water, pouring it vigorously into the bucket.**

    This splashing not only mixes the wort with the additional water but also aerates the wort well.

    The yeast needs oxygen to get off to a good healthy start in the fermentation phase. Because boiled water is virtually devoid of oxygen, you need to put some oxygen back in by aerating the wort. Failure to aerate may result in sluggish and sometimes incomplete fermentations.

20. **Take a hydrometer reading.**

    See the section "Brewing day reading" in this chapter for specific information about this process.

21. **After you take the hydrometer reading and remove the hydrometer, pour the hydrated yeast from the cup or bowl into the fermenter and give it a good brisk stir with your brew spoon.**
22. **Cover the fermenter with its lid and thoroughly seal it.**

23. **Put the fermenter in a cool, dark location, such as a basement, a crawl space, or an interior closet.**

TIP

Don't put the fermenter in direct sunlight or where there's a daily fluctuation in temperatures, such as your garage. This temperature fluctuation can mess with your beer's fermentation cycle.

24. **After the fermenter is in a good place, fill the airlock halfway with water and replace the cap; attach the rubber stopper and position it snugly in the fermenter lid.**

Check to make sure that the fermenter and airlock are sealed airtight by pushing down gently on the fermenter lid. This gentle pressure causes the float piece in the airlock to rise; if it doesn't, you have a breach in the seal. Recheck the lid and airlock for leaks.

Fermentation should begin within the first 24 hours and last anywhere from 7 to 10 days. This wait can be nerve-wracking for first-timers, but patience is rewarded with great beer.

How quickly the beer begins to ferment and how long the fermentation lasts depends on the amount of yeast, the health of the yeast, the temperature at which the beer is fermenting, and whether or not the wort was properly aerated. Healthy yeast, mild temperatures (65 to 70 degrees Fahrenheit), and an abundance of oxygen in the wort make for a good, quick ferment. Old, dormant yeast, cold temperatures, and under-oxygenated wort cause fermentations to start slowly, go on interminably, or even quit altogether.

After your beer has been in the fermenter for about a week or so, check the bubbling action in the airlock. If visible fermentation is still taking place (as evidenced by the escaping bubbles), continue to check the bubbling on a daily basis. When the float piece within the airlock appears to be still and the time between bubbles is a minute or more, your beer is ready for bottling. Before you begin the bottling procedures, however, you need to take a second gravity reading to make sure that the fermentation is complete (see the section "Prebottling reading" in this chapter for specifics on how to do this).

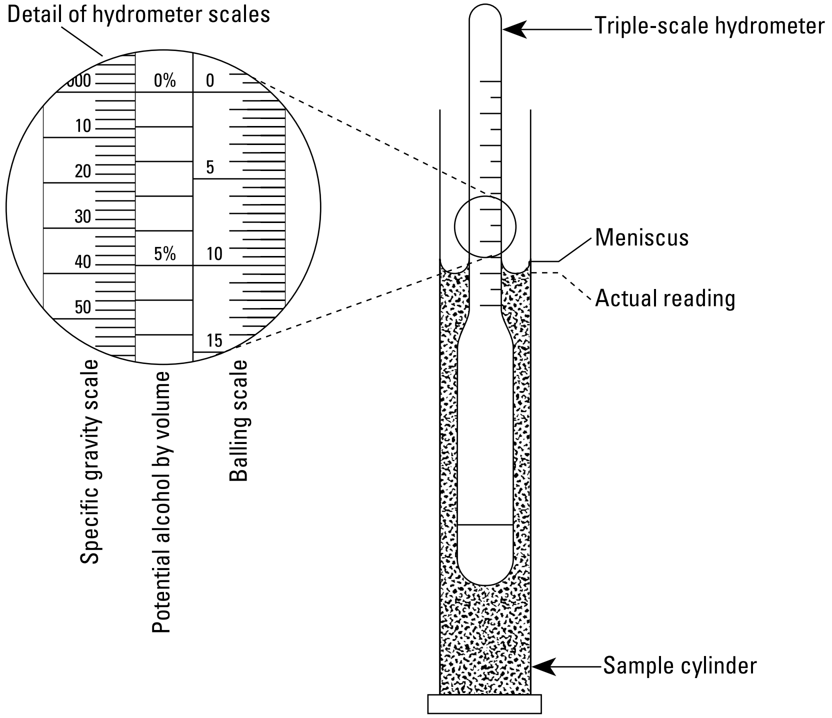
WARNING

Bottling beer before it's finished fermenting may result in exploding bottles.

Taking Hydrometer Readings

A *hydrometer* is a fragile glass measuring device used to calculate the density of your beer in two separate scales: the specific gravity scale and the Bailing scale. (Both scales measure liquid density but in different increments, similar to measuring temperature in Fahrenheit and Celsius.) Most homebrewers use the specific gravity scale.

A hydrometer also measures the amount of alcohol that the yeast has produced in your homebrew. Using a hydrometer and understanding its readings can also call attention to possible fermentation problems. (See Figure 1-3 for a look at a hydrometer in action.)



Detail of hydrometer scales
000
10
20
30
40
50
0%
5%
0
5
10
15
Specific gravity scale
Potential alcohol by volume
Balling scale
Triple-scale hydrometer
Meniscus
Actual reading
Sample cylinder

FIGURE 1-3: A hydrometer displays your brew's liquid density and helps you calculate the alcohol content.

Some people argue that a hydrometer isn't a necessary piece of equipment at the beginner level. But the truth is, a hydrometer isn't expensive, it's easy to use, and anyone who wants to progress in the world of homebrewing needs to learn how to use one. It's the only way to fully know what it is you've just made with your homebrewing endeavor.

The following information shows you how to take hydrometer readings on brewing and bottling days.

Brewing day reading

You want to take the first hydrometer reading on brewing day (see Step 20 in the "Brewing Your First Batch" section of this chapter). To take a good reading, do the following:

1. **Sanitize the hydrometer.**
2. **Lower the hydrometer directly into the cooled and diluted wort inside the fermenter.**

   TIP

   As you lower the hydrometer into the wort in the fermenter, give the hydrometer a quick spin with your thumb and index finger. This movement dislodges any bubbles clinging to the hydrometer that may cause you to get an incorrect reading.
3. **Record the numbers at the liquid surface on the hydrometer scales.**

   You need this information on bottling day to decide whether fermentation is complete and to figure out the alcohol content in your beer. The gravity of your malt extract and water mixture will determine the numbers you see on the scales. Typically, 6 or so pounds of malt extract diluted in 5 gallons of water appear on the hydrometer's O.G. scale as 1.048, and the alcohol potential (as noted on the hydrometer's alcohol potential scale) is around 6 percent.

Prebottling reading

When you think your beer is ready for bottling (based on the bubbling action in the airlock), it's time to take another hydrometer reading. This reading helps you decide whether or not your beer is ready to be bottled:

1. **With your hydrometer test cylinder in hand, take a sample of beer from the spigot of the fermenter.**

   Be sure to fill the cylinder to within 1 inch of the opening, leaving room for liquid displacement of the immersed hydrometer.
2. **Immerse the hydrometer in the beer, record the numbers at the liquid surface of the hydrometer, and compare with those numbers recorded on brewing day.**

   The average healthy yeast consumes at least 65 percent of the available sugars in the wort. If the final gravity reading on your fermented beer isn't 35 percent or less of the original gravity, too much natural sugar may be left in your beer.

Here's a sample equation: If your beer has an original gravity of 1.048, subtract 1 so that you have 0.048; then multiply .048 by 0.35, which results in 0.017. Now add the 1 back in. If the final gravity of your beer is higher than 1.017, you want to delay bottling a few more days.

CALCULATING ALCOHOL CONTENT PERCENTAGE

TECHNICAL STUFF

Want to calculate the alcohol content of your first batch of beer? Of course you do. Here's a sample calculation. If you use about 6 pounds of liquid malt extract for your brew, your original gravity (or *O.G.* in homebrew lingo) is in the neighborhood of 1.048. If your yeast is good and hungry, your final gravity *(F.G.)* a week or so later (after fermentation) will be about 1.012. Because a *ten-forty eight* (also acceptable homebrewer lingo for the 1.048 gravity) represents an alcohol potential of 6 percent, and a *ten-twelve* (the 1.012 gravity) represents an alcohol potential of 2 percent, the yeast produced 4 percent alcohol in your brew. (Subtract the final alcohol potential from the original alcohol potential to derive the alcohol content percentage.)

Bottling Your Brew

Bottling homebrew isn't a difficult procedure, but many brewers often deride it as one that's tedious at worst and boring at best. But for millions of people who brew their beer at home, bottling represents the only option for packaging their finished brew, making it a mandatory step in the homebrewing process.

The American brewing industry continues to package beer — albeit in limited markets — in a variety of 7-, 12-, 16-, and 22-ounce and quart-size returnable bottles; check with your local beer retailer. You can easily purchase brand-new 12- and 22-ounce bottles through homebrew supply shops, but the cost is sometimes prohibitive, mostly due to the cost of shipping.

Using larger bottles is a way to expedite the bottling process as well as free you from its drudgery. The more beer the bottles can hold, the fewer bottles you need. For instance, to bottle an entire 5-gallon batch of beer in 7-ounce nip bottles, you need to clean, fill, and cap more than 90 of them. If you use 22-ounce bottles, on the other hand, you need only 30 of them.

Now, here are the steps for the bottling brigade:

1. **Fill your utility tub or other designated sanitizing basin with enough cold water to cover your submerged bottles, adding bleach or another sanitizing agent according to the manufacturer's directions.**
2. **Submerge as many bottles as you need to contain your full batch of 5 gallons of beer.**

REMEMBER

Make sure your bottles are scum-free before dunking them in the sanitizing solution. Any bottle with dried or living crud in the bottom needs to be scrubbed separately with a cleanser such as trisodium phosphate (TSP) before you sanitize it.

TIP

You can fill and submerge the bottles in less than half the time if you place a drinking straw in the bottles; the straw enables the air in the bottle to escape through the straw instead of slowly bubbling through the opening (your bottling tube with the valve detached suffices here).

3. **Allow your bottles to soak for at least half an hour (or the time necessary according to the package's directions).**

4. **While the bottles soak, dissolve ¾ cup of dextrose in a pint or so of water in one of the saucepans, cover the solution, and place it on a burner over low heat.**

5. **Put your bottle caps into your other saucepan, fill the pan with enough water to cover all the caps, and place the pan on another burner over low heat.**

TIP

Put enough bottle caps for as many bottles as you have soaking plus a few extra; having too many sterilized caps ready for bottling is better than not having enough.

6. **Allow both pans to come to a boil, remove them from the heat, and allow them to cool.**

7. **After the bottles soak for half an hour, connect the bottle rinser to the faucet over the sanitizing tub.**

8. **With one hand over the opening (so that you don't get squirted), turn on the hot water.**

   After the initial spray, the bottle washer holds back the water pressure until a bottle is lowered over the stem and pushed down.

9. **Start cleaning the bottles one-by-one with the bottle brush, and then drain the sanitizer, rinse your bottles with the bottle rinser, and allow them to air dry.**

   Continue this step until all bottles are clean.

TIP

Visually check each bottle for cleanliness rather than just assume that they're all clean.

WARNING

Four dozen free-standing bottles make one heck of a breakable domino effect. Always put your cleaned bottles back into six-pack holders or cardboard cases to avoid an aggravating and easily avoidable accident.

10. **Drain the utility tub of the bottle-cleaning water.**

11. **Place the bottling bucket in the tub and fill it with water and the sanitizing agent of your choice.**

12. **Place the bottling hose, bottling tube, and hydrometer cylinder into the bottling bucket and allow them to soak for half an hour (or according to sanitizing agent directions).**

13. **While the bottling equipment soaks, retrieve the still-covered fermenter from its resting place and place it on a sturdy table, counter, or work surface about 3 or 4 feet off the ground.**

    At this point, you need to set up your bottling station, making sure that you have the priming sugar mixture (still in the saucepan), bottle caps, bottle capper, bottles, and hydrometer with cylinder on hand.

    If you're bottling your brew directly from the primary fermenter, you want to have already taken a hydrometer reading to confirm completion of fermentation. If you're bottling from your secondary fermenter (glass carboy), incomplete fermentation isn't a concern, and you can take a hydrometer reading (to determine final gravity and alcohol content) as the beer drains into the bottling bucket.

14. **After half an hour, drain the sanitizing solution from the bottling bucket through the spigot on the bottom. After the bucket is empty, thoroughly rinse the remaining pieces of equipment (hose, bottling tube), along with the bottles and caps, and bring them to your bottling station.**

15. **Place the bottling bucket on the floor directly below the fermenter and connect the plastic hosing to the spigot on the fermenter, allowing the other end of the hosing to hang inside the bottling bucket.**

    If you're initiating the bottling procedures from your glass carboy, you can't rely on the convenience of a spigot to drain out the beer. You need to use your racking cane and siphon the brew.

16. **Pour the dextrose and water mixture into the bottling bucket.**

    The dissolved corn sugar mixes with the beer as the beer drains from the fermenter into the bottling bucket. After you've bottled the beer, this sugar becomes another source of food for the few yeast cells still remaining in the liquid. As the yeast consumes the sugar, it produces the beer's carbonation within the bottle. Eventually, the yeast again falls dormant and creates a thin layer of sediment on the bottom of each bottle.

    WARNING

    If, by chance, you bottle a batch of beer that isn't fully fermented or you somehow add too much dextrose at bottling time, you may find out first-hand what a mess exploding bottles can make. Excess sugar (whether added corn sugar or leftover maltose from an unfinished fermentation) overfeeds the yeast in an enclosed bottle. With nowhere for the pressure to go, the glass gives before the bottle cap. Kaboom! Mess! Do not over-prime. (Use no more than ¾ cup of dextrose in 5 gallons of beer.)

17. **Open the spigot on the fermenter and allow all the beer to run into the bottling bucket.**

    Don't try to salvage every last drop from the fermenter by tilting it as the beer drains down the spigot. The spigot is purposely positioned about an inch above the bottom of the fermenter so that all the spent yeast and miscellaneous fallout remains behind.

18. **After the last of the beer drains, close the spigot, remove the hose, and rinse it.**

    TIP

    Avoid splashing or aerating your beer as you bottle it. Any oxidation that the beer picks up now can be tasted later. Yuck.

19. **Carefully place the bottling bucket up where the fermenter was, connect the rinsed hose to the spigot on the bottling bucket, and attach the bottling tube to the other end of the hose.**
20. **Arrange all your bottles on the floor directly below the bottling bucket (keeping them all in cardboard carriers or cases to avoid breakage and spillage).**
21. **Open the spigot on the bottling bucket and begin to fill all the bottles.**

    Gently push the bottling tube down on the bottom of each bottle to start the flow of beer. The bottle may take a short while to fill, but the process always seems to accelerate as the beer nears the top. Usually, a bit of foam rushes to the top of the bottle; don't worry! As soon as you withdraw the bottling tube, the liquid level in the bottle falls.

22. **Remove the tube from each bottle after foam or liquid reaches the top of the bottle.**

    Figure 1-4 shows you how full you want your bottles to be.

    TECHNICAL STUFF

    After you remove the bottling tube from the bottle, the level of the beer falls to about an inch or so below the opening. Homebrewers have differing opinions as to how much airspace (or *ullage)* is necessary. Some say the smaller the airspace, the less oxidation that can occur. Others claim that if you don't have correct ullage, the beer can't carbonate properly. Basically, if it looks like the space in bottles of beer from commercial breweries, go with it!

23. **After you completely drain the bottling bucket, close the spigot, remove the hose, toss it inside the bottling bucket, and set everything aside to be cleaned after all the bottling procedures are complete.**

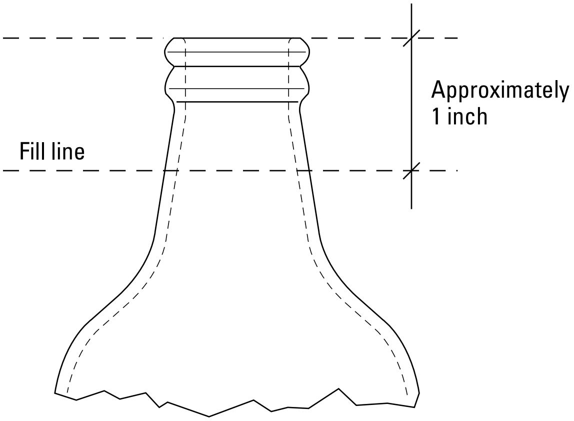


FIGURE 1-4: Correct bottle fill level.

24. **Place all the bottles on your tabletop or work surface. Place a cap on each bottle, position your bottles in the capper (one at a time), and pull down on the capper handle or levers slowly and evenly.**

    You may want to do this task as soon as each bottle is full as insurance against everything that can go wrong when full bottles of your precious brew are sitting around open. A *bench capper*, as seen in Figure 1-5, is free-standing and can be attached to a work surface (permanently, if you like), which leaves one hand free to hold the bottle steady.

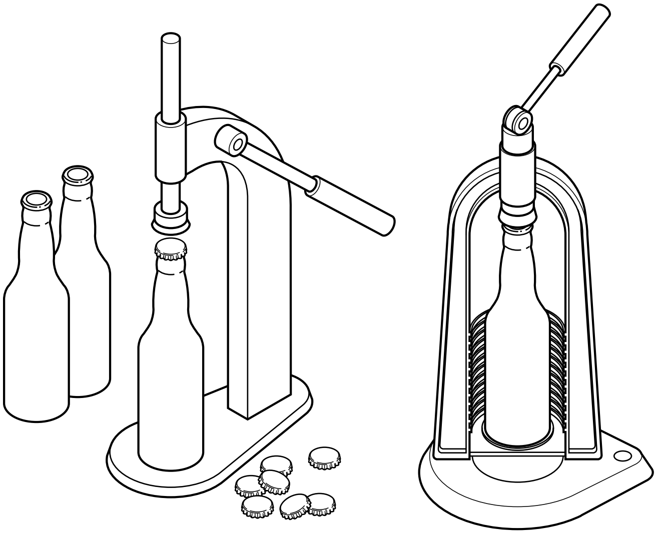


FIGURE 1-5: You can attach a bench-type bottle capper to a work surface for easy use.

TIP

Both bench- or two-handle-style cappers come with small magnets in the capper head designed to hold and align the cap as you start crimping. Many homebrewers don't trust the magnet to hold the caps in alignment and prefer to seat them on the bottles by hand.

Occasionally, a cap may crimp incorrectly. If you suspect that a cap didn't seal right, tilt the bottle sideways and check for leakage. If you find you have a leaker, yank the cap and replace it. (You boiled extras — right?)

25. **Your homebrew needs to undergo a two-week conditioning phase, so store your liquid lucre in a cool, dark location (such as the same place that you kept the fermenter).**

    This phase is where the remaining yeast cells chow down on the dextrose and carbonate your beer.

    WARNING

    Putting your brew in the fridge isn't a good idea — at least for the first two weeks — because the cold temperatures stunt the yeast's carbonating activity. Aim for fifty degrees Fahrenheit.

26. **Thoroughly rinse your brewing equipment in hot water and store it in a place that's relatively dust- and mildew-free. You may even want to go that extra step and seal all your equipment inside a large-capacity garbage bag.**

After two weeks pass, check to see whether the bottles have clarified (the yeasty cloudiness has settled out). Chill a bottle or two for taste-testing. Like any commercial beer, you need to decant homebrew before drinking, not only to release the carbonation and the beer's aromatics but also to pour a clear beer. Drinking homebrew out of the bottle stirs up the sediment, creating a hazy beer.

IN THIS CHAPTER

- **Grasping the science behind creating food through fermentation**
- **Diving in with recipes for fermented veggies, dairy, and drinks**
- **Making sourdough bread**

Chapter 2
Fermenting

You may not realize it, but you're likely already a consumer of one or more fermented food products. Have you had any sourdough bread, soy sauce, tofu, yogurt, cheese, or a glass of cider or wine lately? Does your sandwich come with a salty pickle or some sauerkraut on the side? You can thank the process of fermentation for these items.

Although fermentation is technically a method of preserving food (like the techniques covered in Book 2), the chemical process changes that food into something different. In the modern kitchen, fermentation is a natural and fun way to discover new flavors and recipes and go on a mind-bending adventure through a history of food that has existed for centuries around the world. If you're lucky, fermentation can even act as a tool for self-discovery and a vehicle for self-exploration in health and healing.

This chapter gets you started on that path with a little behind-the-science of fermentation and a lot about making your own fermented foods.

Getting Familiar with Fermentation

Fermentation turns sugars to alcohol or other acids using yeast and bacteria. The chemical change often involves increasing the acidic environment and develops in places without oxygen (*anaerobic* conditions).

Fermenting is a glamorous term for decaying your food in a controlled method. Yes, you're allowing your food to decay. Your food is decaying from the moment you pick it. If you ferment correctly, you create the perfect environment of temperature, liquid, and oxygen (or lack thereof) to change your food into a delectable, sometimes healthier food. After a food has been fermented, it not only tastes different but also *is* different on a molecular level.

Fermented foods have existed for centuries as populations around the globe learned how to capture the slow decomposition process of organic materials and preserve them by adding salts, sugars, or yeasts. They controlled mold and promoted good bacteria with the intention of maximizing the shelf life of their foods, enhancing flavors, or gaining health benefits.

Fermenting releases some nutrients that would otherwise be unavailable for digestion and creates an environment for *probiotic*, or beneficial, bacteria to thrive. These bacteria already live in a healthy digestive tract and help break down food properly. Antibiotics and digestive illnesses can reduce the number of good bacteria, making you susceptible to illness. Your immune system includes your digestive tract, and improving digestion can only help overall health.

If you've never fermented, don't worry. The piquant taste is something that's enjoyable for most people and unforgettable to anyone who tries it. Fermenting is a technique that you can try without a lot of financial investment in equipment and specialty supplies. It has always been a simple way of preserving foods, easy enough to do in the homesteading kitchen.

REMEMBER

Fermenting is decaying with style. There's a fine line between going bad and fermenting, so the rules of a good fermenting system are stringent. These rules become easier to adhere to as you become proficient, and the benefits are worth it.

Fermenting Essentials

The fundamental things you need to ferment foods are often the same, but the many variations of those ingredients can change your results:

- **Fermenting containers:** Fermented foods must be made without the presence of oxygen or spoilage will occur. A good fermenting container is essential to your success. Use a sturdy container that's large enough to hold your fermented goods. Containers are best made from glass, such as Mason jars, or nonreactive materials, such as a crockpot made from ceramic or a well-cleaned plastic bucket. The key to fermentation is creating an anaerobic, or oxygen-free, environment by sealing out any outside air.

TIP

Look for fermentation jars with an airlock seal that allows gas to escape but no air to get inside, though in some recipes a weighted lid will do the trick.

TIP

Sometimes people use a weighted object to cover their food as it ferments. Whether you use one depends on the fermenting container you're using. Keeping your food submerged under the wet brine is most important. A weight, something as simple as a heavy plate or a plate with a stone on top, helps to put pressure on the top of your container and pack down your food.

- **Lactobacilli:** These naturally occurring bacteria are essential to the fermentation process. These good bacteria have been proven to fight intestinal inflammation and help create a healthy gut. They also enhance the flavors and digestibility of fermented foods — they're the invisible workers that make your food ferment!
- **Salt:** Salt can kill any bacteria that may cause illness. It does this by removing water from the plant cells, creating a less inhabitable environment. Salt also helps enhance the flavors of food. It can reduce sweetness or bitterness in foods, a desirable thing for your recipes!

TIP

The common table salt most folks have on hand has iodine added, as well as some chemicals to keep it from clumping, and it isn't the best salt for fermenting. But most stores sell kosher, canning, and sea salt, and all those are fine for your fermenting projects.

- **Spices and herbs:** You add herbs and spices to your fermented foods to create unique recipes. Think of adding ginger to your kombucha, cranberries to your sauerkraut, or caraway seeds to your pickled goods!
- **A starter or a culture:** Many fermented recipes require a starter or a culture. No, we're not looking for you to adopt a new way of life; this type of culture is one full of existing microbial life. A fermentation starter can come in the form of a dried powder, yeast, or a wet substance and is essentially used to boost the food's flavor and the digestion process. You can get good results using a kick-start from a previous batch to accelerate the fermentation process. You can purchase starters or, depending on the product, reuse them from other food products such as sourdough or yogurt.
- **Sugar:** Almost all fermenting recipes call for some sweetener, usually sugar. Sugar helps feed the good microbes as they get started fermenting your food. When a recipe calls for sugar, you can use organic raw sugar or regular table sugar. You also use sugar to help preserve foods when salt would be undesirable. (Imagine making jam or kombucha with salt. Yuck!) Most commonly used in wet brine, sugar can include cane sugar, honey, or maple syrup.

WARNING

Don't use sugar substitutes or half sugar-half substitute products in a fermenting recipe. These don't feed the good microbes and may also contribute to an off flavor in food. After food is through fermenting, if you feel it needs additional sweetener to taste good, you can add a sugar substitute.

PICKLING VERSUS FERMENTING

Fermenting and pickling can seem similar, but they're not the same thing. The process that occurs inside the saltwater solution of a pickling brine is called *fermentation,* and the act of making brine and placing food into that solution is called *pickling.* Pickling also usually requires added heat through a canning process, whereas fermented goods can sit out on your shelf and don't require heat. Fermented foods thrive in anaerobic conditions and make use of naturally occurring "good" bacteria submerged under the saltwater. Fermented foods have a bit of tangy flavor, while pickled goods taste salty or vinegary all the way through. When making fermented foods, you actually sour the food rather than pickle it.

The role of salt in fermentation is to help draw out water from foods and make a salty living environment so bad bacteria have little chance of survival. A brine is created in fermented recipes to preserve fruits and vegetables or other food products. Making brine can be a bit of an experiment, and the salt measurements sometimes depend on your personal preference. Remember that a little salt goes a long way! Some brine even contains a bit of sugar to balance out the salty flavor.

For much more on pickling, see Book 2, Chapter 4.

- **Time:** Every good fermented food product needs time. The tiny microbes will work to turn those starches into sugars and alcohol and will slow down only if you place them in cooler temperatures. Depending on the end product, you'll leave your ferments anywhere from two to seven days, or longer! Check your recipe and taste your food according to the flavors you desire.

Cleaning, Sanitizing, and Sterilizing

When fermenting, having a clean work space and tools ensures that your good bacteria outnumber the bad. This means your chances of creating a delicious fermented food are much greater. In short, cleaning your work area and equipment is essential to the final product:

- Cleaning means washing containers and equipment with hot water and soap. You can do it in a dishwasher or by hand. You should remove all visible particles of food or dirt. Always clean things before sanitizing or sterilizing them.

- Sanitizing is done with chemicals. The easiest thing to use is chlorine bleach — bleach without scent or color added. Add 1 tablespoon of bleach to each quart of warm water and soak your containers and utensils in it for five minutes. Everything must be submerged in the water. You can use a clean sink or large tub for sanitizing. If you can't submerge an item, soak a clean cloth in bleach solution and wipe the item. Use a different cloth for each item.

  Alternatively, brewing shops and stores that cater to commercial restaurants carry other chemical sanitizing agents. Follow the label directions for their use, and always rinse your containers and utensils with clean water after sanitizing.

  TIP

  You don't need to sanitize your containers and equipment if you're going to sterilize them.

- **Sterilizing** means boiling your equipment and supplies in water for three minutes. Your equipment and containers must be able to stand up to this temperature without melting. In some cases, you pour boiling water into larger containers and allow them to sit for a few minutes, but this isn't perfect sterilization. Some dishwashers actually have a sterilize setting that you can use.

Fermenting Vegetables (including Sauerkraut and Kimchi)

Naturally crisp and crunchy vegetables make satisfying ferments. You'll notice that many of the recipes in this section feature vegetables that come into season toward the end of summer and into fall. This allows you to create ferments that will last you well into the colder months.

Sauerkraut, which is simply cabbage (and salt), and its Korean cousin kimchi are perhaps the best-known fermented vegetables.

Vegetables contain all the lactic acid they need to trigger fermentation, so technically, you don't need to add a starter. In practical terms, though, salt is almost always used for flavor and to slow fermentation. It also offers these benefits:

- Salt pulls water out of vegetables, which helps submerge them in liquid, inhibiting bacterial growth.
- Salt promotes lactic acid bacteria (the "good guys") so they can crowd out other bacteria.

The key to fermenting vegetables is to ensure that they're covered with a liquid. This creates an oxygen-deprived environment where "bad" bacteria is unable to grow.

Fermenting vegetables is an easy process that involves only a few steps and a bit of time.

Preparing your vegetables

You can chop, shred, or leave your veggies whole, depending on the vegetable you're using and the end result you want to achieve. Sauerkraut is most often shredded, whereas cabbage for kimchi is traditionally chopped in larger pieces. Root vegetables can be cubed or sliced thin for a different texture. Cucumbers can be sliced into coins, halved, or left whole.

Salting

The two basic approaches to salting vegetables for fermentation follow:

- **Brine:** Dissolve salt in water. Add to your fermentation vessel with the vegetables, making sure that they are completely covered. Some recipes call for soaking vegetables in a brine for a few hours to soften them before draining and packing as usual.
- **Dry salt:** Sprinkle salt on your prepared vegetables, then massage and pound them (with a spoon or even your hands) until they release enough juice to cover them in your chosen fermentation vessel.

TIP

You can make a basic brine by dissolving 3 tablespoons of sea salt in 1 quart of water. Use this ratio to make whatever quantity of brine you need. Then just pour over your veggies and let the fermentation begin!

Packing the jars

After your vegetables have been chopped and salted, it's time to pack them up. Add them to your jar or crock and press down to submerge the vegetables in their juices and release any air bubbles. This could take some time, so keep trying if at first it doesn't seem like there's enough juice to cover them. If the vegetables still aren't covered, you can add some filtered water.

Waiting and tasting (and waiting some more!)

How quickly your vegetables ferment will depend on a few factors, including how much salt was used in the preparation and how warm the location is. More salt will result in a slower ferment. A warmer room will speed it up.

Your vegetables will start to ferment after a few days, but the process will continue for much longer. Traditionally, fermented vegetables were prepared to preserve the harvest through winter, so keep that in mind when deciding when your batches are ready. The flavors will change and grow as days and weeks go by.

After your ferment has reached its peak (according to your own tastes), move it to the fridge. It will still continue to ferment, but at a much slower pace. And it will probably be eaten before too long!

Sauerkraut

PREP: 30 MIN | FERMENT: 3–4 WEEKS | YIELD: 4 QUARTS

INGREDIENTS

5 pounds cabbage

3 tablespoons canning salt

1. Peel off damaged outer leaves of cabbage. Quarter the cabbage and remove the hard core. Finely shred the cabbage by hand or use a food processor.

2. Scald a glass gallon jar with boiling water. Add a 1-inch layer of the cabbage mixture to the jar. Sprinkle with salt. Tamp firmly with a wooden utensil to remove any hidden air pockets and bruise the cabbage, making it release juice. Repeat Step 2 until all ingredients are used up.

3. Cover the jar with a coffee filter and leave for two hours to allow time for the salt to draw out water from the cabbage. Every 30 minutes, tamp down the cabbage to help draw out brine and force it to be submerged.

4. After 2 hours, if you still don't have enough natural brine, mix 1 teaspoon canning salt to 1 cup water and pour over mixture. When the cabbage is fully submerged, remove the coffee filter and place a small saucer that fits just inside the top of the jar so it rests directly on the submerged cabbage. Add a weight, such as a water-filled quart jar, to keep the saucer and product under the brine.

5. Cover with a clean dishcloth to keep out dust and insects. Place the jar out of the way, at room temperature. Check the jar daily, for three to four weeks. Skim off any scum that may build up on the top. Replace the clean dishcloth with another each time you remove scum buildup.

Spinach Sauerkraut

PREP: 30 MIN	FERMENT: 3–4 WEEKS	YIELD: 4 QUARTS

INGREDIENTS

1 cup chopped spinach

5 pounds cabbage

3 tablespoons canning salt

1 Wash spinach in plenty of water, rinse well, and chop it into thin shreds.

2 Peel off damaged outer leaves of cabbage. Quarter the cabbage and remove the hard core. Finely shred the cabbage by hand or use a food processor. Add spinach and mix together so they are evenly incorporated.

3 Scald a glass gallon jar with boiling water. Add a 1-inch layer of the cabbage and spinach mixture to the jar. Sprinkle with salt. Tamp firmly with a wooden utensil to remove any hidden air pockets and bruise the cabbage, making it release juice. Repeat Step 2 until all ingredients are used up.

4 Cover the jar with a coffee filter and leave for two hours to allow time for the salt to draw out water from the ingredients. Every 30 minutes, tamp down the ingredients to help draw out brine and force the cabbage mixture to be submerged.

5 After two hours, if you still don't have enough natural brine, mix 1 teaspoon canning salt to 1 cup water and pour over mixture. When the mixture is fully submerged, remove the coffee filter and place a small saucer that fits just inside the top of the jar so it rests directly on the submerged cabbage. Add a weight, such as a water-filled quart jar, to keep the saucer and product under the brine.

6 Cover with a clean dishcloth to keep out dust and insects. Place the jar out of the way, at room temperature. Check the jar daily, for three to four weeks. Skim off any scum that may build up on the top. Replace the clean dishcloth with another each time you remove scum buildup.

Kimchi

PREP: 20 MIN, PLUS STANDING	FERMENT: 2–3 DAYS	YIELD: 1–2 QUARTS

INGREDIENTS

1 medium Napa cabbage

1 to 2 inches fresh ginger

1 medium onion

1 head garlic

½ cup salt

3 tablespoons soy sauce or tamari

1. Wash, core, and chop the cabbage into ½- to 1-inch pieces. Peel and shred the ginger and onion. Peel garlic, but leave the cloves whole.

2. Place a layer of cabbage in a glass gallon jar. Sprinkle the salt over the cabbage. Repeat until all cabbage is used. Allow the cabbage and salt to sit at room temperature for 6 hours. Rinse the salt off the cabbage and place the cabbage in a large mixing bowl.

3. Mix the ginger, onion, garlic, and soy sauce with the cabbage. Place the mixture in a glass gallon jar. Cover the filled jar with cheesecloth.

4. Allow to ferment at room temperature for two to three days. Place the jar in the refrigerator to ferment for another week, or until the desired taste has developed.

Fermented Garden Vegetables

PREP: 20 MIN | FERMENT: 1 WEEK | YIELD: 1 GALLON

INGREDIENTS

1 green pepper

1 red pepper

1 yellow pepper

1 head garlic

2 medium onions

1 head broccoli

1 head cauliflower

2½ tablespoons sea salt

2 quarts water

1. Scald a glass gallon jar with boiling water. Remove the seeds from all the peppers and thinly slice them into rings.
2. Peel the garlic cloves. Peel and thinly slice the onions. Cut the broccoli and cauliflower into florets.
3. In a large pot, combine the salt and water. Place all the vegetables in a gallon jar and pour the saltwater brine over all. Place a saucer that fits inside the jar directly onto the vegetables to hold them under the brine.
4. Cover the jar with a muslin cloth and place it in an out of the way place at room temperature. Check the jar daily, removing any scum, washing and replacing the saucer and recovering the jar with a clean cloth.
5. After the fourth day, taste for a desired flavor. After one week, place the jar in the refrigerator for up to a month.

TIP: Consider changing up your veggies by trying this with carrots, beets, green beans, or red cabbage.

Garlic Dilly Beans

PREP: 10 MIN	FERMENT: 7 DAYS	YIELD: 1 QUART

INGREDIENTS

1 cup fresh green beans

3 cloves garlic

1 teaspoon dill seed or 2 fresh dill heads

Basic brine

1. Soak the green beans in cool water to get firm and crisp.
2. Pack all the ingredients in a 1-quart size jar.
3. Pour over brine to cover all the beans.
4. Leave a 1-inch space at the top of jar, put on lid and band, and screw tightly.
5. Allow to ferment at room temperature for three to seven days.
6. Transfer to the fridge when ready; they will keep for several months.

TIP: This recipe is the perfect way to make your tender sweet summer green beans last longer. They stay crisp in the brine and taste delicious next to some quinoa or in a salad.

Starting Sourdough

When you begin exploring the world of fermentations, you'll hear people talking about sourdough, sourdough starters, and wild yeasts. A sourdough starter is really just another name for any fermented grain. It's a grain that starts to predigest during the fermentation process, which ultimately makes the flavor sourer.

Here are just a few great reasons to make your very own sourdough:

- Sourdough is delicious.
- Sourdough helps improve your digestion.
- Sourdough predigests gluten and phytic acid.
- Sourdough saves you the cost of buying commercial yeasts.
- Making the sourdough starter and keeping it alive is fun.

You can use anything from spelt flour to whole wheat to kamut to other ancient grains to experiment with sourdough. You'll be surprised just how many recipes you can make, from muffins to pancakes to breads . . . anything goes!

TIP

Kamut is a type of ancient grain that's 20 to 40 percent higher in protein than wheat and is richer in several vitamins and minerals. Unlike some grains, kamut has a low oxidation level and retains most of its nutritional value after grinding and processing. It can be purchased at many high-end markets, health food retailers, and a growing number of grocery stores.

Feeding your sourdough starter with tender loving care

If you care about your sourdough starter, you'll feed it. Just like your body, sourdough requires food. The fermentation process feeds off of the sugars and carbohydrates in the flour. To keep the sourdough alive, consistent and regular feeding of flour is required. As long as you keep feeding your sourdough and store it in a good environment, it will stay alive, and you can keep making more recipes with it.

Sometimes you'll even hear people call the sourdough starter the *mother* because it creates other sourdough babies. Sourdough starter is very different from commercial yeasts, which require you to continue buying them and have a strong need for a stable environment. Sourdough is unique because it predigests the gluten and phytic acids in the grain.

Choosing the type of sourdough starter to use

All sourdoughs require a sourdough starter, the essential life force that makes your amazing breads and other recipes. The interesting thing about these starters is that they take on the flavor of the naturally occurring yeast and bacteria in your environment and the flour you use. From one batch to the next, each sourdough is a bit unique and different from the last!

You can purchase dry sourdough starters or find a friend who has a wet sourdough starter. But making your own starter is easy. It does take up to a week, but it's a pretty hands-off process that lets you take full credit for your sourdough from start to finish. You're a homesteader: Why spend money to buy something you can make instead?

A dry sourdough starter may come as a dehydrated formula that contains sourdough yeast. A wet sourdough starter is a more traditional culture that has been started from scratch, fed continuously with flour, and is now bubbling and alive. It's wet and sticky. When such a wet starter is fully thriving, it should be fed with water and flour at least once a week. See the upcoming recipes for a sourdough starter recipe, along with recipes for breads, muffins, and more.

Sourdough Starter

PREP: 5 MIN	FERMENT: 5–6 DAYS	YIELD: 2 CUPS

INGREDIENTS

2 cups flour of your choice (except white flour)

2 cups filtered water

1 packet dry yeast

1. Place ¼ cup of water into a wide-mouth jar. Then add ⅜ cup of your chosen flour and mix well.

2. Stir the flour and water well. This brings in air and helps oxygenate your starter. Make sure you scrape all the sides and get all the flour into the starter.

3. Cover the jar with a cloth napkin or paper towel and secure with a rubber band.

4. Let the starter sit in a relatively warm place for 12 to 24 hours. Room temperature is ideal; you don't want to exceed 85 degrees.

5. By now you may see some bubbles in your mixture. Every 12 to 24 hours, discard half the starter and mix another ¼ cup of water and ⅜ cup of flour in the same jar as your starter. As it begins to expand over the next several days, your starter will start to get bubbly and fluffy and have a slight sour smell.

6. If you don't see any bubbles yet, your starter may need help to make room for good bacteria. Try removing about half of the starter from the jar and adding another ¼ cup of water and ⅜ cup of flour. Let the starter sit for another 12 hours until bubbles occur and you see it grow in size.

7. Reserved starter should be kept in a crock or jar and stored in the refrigerator. (If using a screw-top jar, keep the lid loose instead of airtight to allow the starter to continue its natural expansion.) Feed stored starter once a week with the same water-and-flour mix to keep it wet and thriving.

NOTE: If you're using a dehydrated starter, simply open the package, empty the contents into the jar, and follow the same steps.

NOTE: The starter will get bigger the more you feed it. You may need to discard some of it or transfer it to larger containers along the way. Also, the presence of liquid (which you can stir in) and a sour smell are normal.

NOTE: You can end up discarding a lot of starter as you're nursing it along. Share some with a homesteading friend, or search online for recipes that call for *discarded starter.* Put it to delicious use by turning it into pizza crust, pretzels, waffles, even chocolate cake!

Traditional Sourdough Bread

PREP: 10 MIN
COOK: 45 MIN
YIELD: 1 LARGE LOAF

INGREDIENTS

2 cups kamut sourdough starter

1 tablespoon coconut sugar

4 cups kamut flour

2 teaspoons salt

1. In a large mixing bowl combine the starter, coconut sugar, and salt. Adding 1 cup of flour at a time, stir in as much as you can with a wooden spoon.
2. When the dough is firm enough to knead by hand, roll it on a lightly floured surface until the dough is no longer sticky. Knead it by hand so it is moist and flexible!
3. Wash the mixing bowl with some hot water, dry it, and place the dough in the warm bowl. Cover the bowl with a dishcloth and let the dough rise in a warm place until it has doubled.
4. Now for the fun part: Punch down the dough! Form it into one round loaf and let it rise a second time on a lightly greased cookie sheet.
5. Bake the loaf in a preheated oven at 350 degrees for 40 to 50 minutes or until the crust is brown. The bread should feel hollow when you give it a tap!
6. It's hard to resist, but let your bread cool before you slice and serve it!

NOTE: If your kitchen isn't warm enough for your bread to rise, try putting it in a cold oven with the oven light on. The light bulb may raise the temperature inside just enough to do the trick, but remember not to preheat the oven for other baking!

Mooving On to Dairy

Fermenting dairy provides not only delicious food but also improved nutritional value. Many people who have assorted digestive issues see improvement with regular consumption of fermented dairy.

In fact, fermenting dairy can make it tolerable and even healthful to someone who's lactose intolerant. Through the fermentation process, the beneficial bacteria consume the lactose and turn it into lactic acid. There's also evidence that eating fermented foods on a regular basis helps reestablish a healthy level of beneficial bacteria in the gut, improving all digestion.

Making lactose tolerable by fermenting

Many dairy products that are familiar on the store shelf can be naturally fermented and well tolerated by those who are lactose intolerant. The following list is by no means exhaustive, but does include some of the more common forms of fermented dairy:

- **Buttermilk:** True cultured buttermilk isn't a grocery store item. It's fermented with a variety of *lacto* bacteria that gives it the tang and health benefits of a fermented product.
- **Cheese:** The largest class of fermented milk products, cheese is created by using specific bacteria and molds developed for specific flavors and textures.
- **Cultured butter:** You create this product by adding some cultured buttermilk to the cream you churn. Allow it to ripen and then make your butter.
- **Kefir:** Kefir is created with bacterial grains that resemble cauliflower. These gelatinous grains are removed and reused again. They eventually grow in size and can be divided to share.
- **Koumiss:** This fermented, carbonated dairy drink was traditionally made from mares' milk in central Asia. Koumiss has been used medicinally in various times. Depending on the level of fermentation, it can contain varying degrees of alcohol. The recipe for the version in this chapter uses yeast to start the fermentation.
- **Sour cream:** Cultured sour cream is different from the product found on most grocery shelves. The fermenting process results in a deliciously acidic food, using *Lactococcus lactis,* a bacterium that's also used in the making of buttermilk and many cheeses.
- **Yogurt:** Yogurt is usually made from dairy milk and beneficial bacteria such as *Lactobacillus bulgaricus* and *Streptococcus thermophilus.* You can use a small scoop of finished yogurt to start a new batch, in an endless cycle.

Choosing pasteurized or raw milk

Many fermented food enthusiasts recommend using only raw milk products to make fermented dairy. Does this mean that any dairy you use must be raw? What is *raw*, anyway? Read on for an explanation of the different processes that milk undergoes before you purchase it:

- **Raw:** This means that the milk has gone through a filtering process and nothing else. No heat has been applied to the milk, and it will separate into a layer of cream and a layer of milk if left undisturbed. Raw milk still contains the enzymes that are naturally present, and instead of going sour over time like store milk, it simply clabbers, or ferments. Raw milk isn't legal to sell in all states, so check your local laws before buying it.

  REMEMBER

  The argument against raw milk is that it may contain harmful bacteria and may transfer disease to the people who drink it. Although this is true in theory, raw milk farmers go through the same rigorous hygienic standards as farmers who pasteurize their products. In fact, some are held to even higher standards for bacterial counts than their pasteurizing neighbors. Advocates of raw milk believe that drinking raw milk with the natural enzymes and good bacteria still in it is healthier than drinking a sterilized milk product.
- **Pasteurized:** This is the process of heating milk to kill certain types of bad bacteria, such as *E. coli* or *listeria.* Milk is heated to 145 degrees for a period of time and then rapidly cooled.
- **Homogenized:** For this process, milk is agitated and filtered to break the naturally occurring fat into small enough particles that it no longer separates into a layer of cream and milk.
- **Ultra-pasteurized:** This type of milk is more common in Europe, although it has become more popular in the United States in recent years. In ultra-pasteurization, milk is heated to 280 degrees for 2 seconds and then rapidly cooled. Ultra-pasteurization makes the milk shelf-stable for up to 70 days from the day of processing, when it's packaged in sterile containers.

Some recipes require the separation of cream and milk, and if that's how a recipe is listed, following the recipe is best. You can separate some milk by allowing it to sit without movement for a few hours or overnight. Cow's milk is like this. The next morning, you have a thick layer of cream atop the lower-fat milk underneath. This lower-fat milk is still not the nonfat variety sold in stores, but it is lighter tasting.

WARNING

However, you shouldn't leave goat milk to separate. The naturally occurring caprylic acid increases over the life of the milk, and you end up with a goaty-tasting product. (Sorry, but that's the best way to describe it.) Avoid this by using a cream separator turned to the lowest setting to remove the cream from goat's milk.

REMEMBER

Not all milks are created equal. They're all nutritious, but the flavor and texture of the finished product can be wildly different. As you start fermenting your own dairy products, remember that they won't be the same as store-bought examples. They won't contain thickeners and sweeteners like the products on the grocery shelves usually do.

If you find that the flavor of your fermented dairy is not to your liking, you can change the type of milk and see whether that helps, or you can ferment for a shorter period of time. The longer you leave a food to ferment, the tarter it becomes.

Sourcing your starter cultures

After choosing your milk, your next step is to find out where to buy the specific cultures needed to make your own fermented dairy products.

If you're trying to start your home-fermented products by using store-bought varieties, check that the beneficial bacteria are present. You need a living food to use as a starter for the next batch of living food. If you're shopping at a health-food store, tell the clerk you're looking for live cultured products. These products may have to be processed according to your state's food laws.

Another option is to buy a fermented food culture from someone who's also fermenting. The nice thing about fermented foods is that, after you have a batch going, you then have the future starter to make more indefinitely. Saving a bit from one batch to the next also creates a specific culture that loves where you're keeping it!

Keep in mind that starters are living bacteria. They're best kept at the proper temperature and fed regularly.

Serving and storing fermented dairy products

Fermented dairy products are cultured at room temperature or above. After they reach the desired fermentation, you chill them to slow the fermentation. For fermented dairy recipes, follow the recipe to the letter, taste it, and decide whether to stick with the same storage time based on how well you like the flavor. Though properly fermented food doesn't go bad, it does eventually become too sour-tasting to enjoy eating.

Serve fermented dairy products at their optimal flavor, especially when you're introducing someone to the idea of home-fermented items. For someone who's new to the taste, the tanginess may be off-putting if the product is overripe.

TIP

When serving things such as yogurt and kefir, many people expect a highly sweetened taste. To retrain their palate, many add a bit of fruit or natural sweeteners such as honey, maple syrup, or organic sugar to the recipe. They can slowly cut back as their taste develops for the unsweetened product.

Trying your hand at cheese

Cheese making is fermenting, although cheese isn't often put in the same category as other fermented dairy products such as kefir. The idea behind creating a cheese through fermenting is the same: You introduce the proper bacteria (or culture) to the milk, and eventually the proper fermenting happens, and you have a fairly predictable flavor.

Despite how technical modern cheese making has become, it all comes down to a few basic steps:

1. **Bring the milk up to temperature (to simulate the animal's body temperature, which activates the starter culture) and add the starter culture.**

   You can make cheese from virtually any milk, but most modern-day recipes recommend the type of milk to use and also what alternate milks can be used. The ingredient that's not always interchangeable is the added amount of cream. When a cheese recipe asks for both a measure of milk and cream, you must add both.

2. **Add a coagulant, such as rennet.**

   Rennet is the magic that makes cheese happen. Rennet is an enzyme in the stomach of ruminants that have yet to start grazing or chewing their own cud. It's sold in stores in liquid and tablet form, and your recipe will recommend one or the other.

   When purchasing rennet, look for it in the refrigerated section of the store. It's usually in the dairy section, although some stores keep it in the meat department.

   TIP

   Many times, the rennet is interchangeable, but breaking off a fraction of a tablet, instead of measuring out the equivalent in drops of liquid, may be difficult.

3. **Form and mold the curd, and drain the whey.**

   Instead of discarding the whey, you can use it as a vitamin and protein booster in smoothies, as a cooking liquid for potatoes or pasta, as animal feed, on your hair and skin, or as a compost pile addition! An online search will lead you to plenty of creative ways to reuse whey.

4. **Salt the cheese.**

   Salt slows down enzymatic activity, enhances flavor, and keeps unwanted organisms away, such as bacteria that can ruin the cheese or sour the taste. Salt also draws out moisture and helps form the rind, or the outside of the cheese.

5. **Age the cheese (during which rind develops, with the exception of fresh cheeses).**

   This stage needs to be done in a controlled environment because, just like the regular rules of fermenting, you're trying to grow the bacteria you want and avoid giving the unwanted bacteria a chance. Every style of cheese requires a different treatment.

Some recipes omit one or more of these steps, but all cheese requires the milk to at least be brought up to temperature so it can coagulate. This is where the proteins clump together to form curds.

Homemade Yogurt

PREP: 20 MIN	FERMENT: 7 HR	YIELD: 1 QUART

INGREDIENTS

2 quarts cow or goat milk

2 tablespoons yogurt that contains active cultures

1 In a 6-quart pot, heat the milk to 185 degrees. Don't allow the milk to boil. Cool the milk to 110 degrees by placing the entire pot into an ice-filled sink and swirling it around.

2 Add the yogurt to the cooled milk, stirring well. Pour the yogurt into the container that you'll be storing it in and place it in a dehydrator with an accurate thermometer gauge. Keep the yogurt at 110 degrees for seven hours, or until it thickens and is as tangy as you like.

3 Refrigerate the finished yogurt until ready to eat. Store it for up to two weeks in the refrigerator. Keep 2 tablespoons of this yogurt as the starter for the next batch.

NOTE: Goat's milk yogurt is naturally looser than cow's milk yogurt. This is normal.

NOTE: If you don't have a dehydrator or yours is too small to hold your containers, many people have success using a turned-off oven with the light on or a picnic cooler with a hot water bottle or heating pad inside. Many programmable pressure cookers now have a yogurt-making setting, and fully dedicated yogurt-making machines are available, too.

VARY IT! Flavor your yogurt by adding ¼ to ½ tsp of vanilla or lemon extract and ⅛ to ¼ cup of sugar per quart.

Kefir

PREP: 20 MIN | FERMENT: 24 HR | YIELD: 1 QUART

INGREDIENTS

4 tablespoons kefir grains

1 quart milk

1 Place the grains in the bottom of a quart canning jar. Pour the milk over the grains, leaving ½-inch head space.

2 Cover the jar with a coffee filter and place an elastic band around the filter, if desired. Place the jar in an out-of-the-way place at room temperature.

3 After 24 hours, the kefir is ready. Strain out grains for the next batch and refrigerate the finished kefir. Store the kefir in the refrigerator for up to one week.

TIP: You can find kefir grains by doing a search online. A huge community of kefir drinkers willingly shares grains through the mail.

NOTE: Kefir is carbonated at first. Be aware that it can bubble over if agitated too much after it's finished. Never use metal utensils in any part of kefir making.

Koumiss

PREP: 30 MIN	COOK: 30 MIN	FERMENT: 2 DAYS	YIELD: ABOUT 1 GALLON

INGREDIENTS

1 gallon goat milk

2 tablespoons honey

⅛ teaspoon champagne yeast

¼ cup warm water

1. Heat the goat milk to 180 degrees in a stainless-steel pot and remove any film that forms. Add the honey and allow the mixture to cool to 70 degrees.

2. Dissolve the champagne yeast in 115 degree water and let it stand for ten minutes. Stir the yeast mixture into the milk. Cover it with a clean cloth and allow it to stand at room temperature until it foams (about 24 hours).

3. Pour the koumiss into sanitized beer bottles that can withstand carbonation pressure. Fill only to 1 inch below the bottom of the neck of the bottle.

4. Store the koumiss at room temperature for 24 hours and then refrigerate. Shake the bottles gently every few days but not just before opening.

TIP: You can buy the champagne yeast at a beer maker's shop.

TIP: Koumiss keeps for six to eight weeks but then becomes increasingly acidic. You can add honey to hide the acidic taste.

Cottage Cheese

PREP: 30 MIN, PLUS STANDING AND STORING	COOK: 45 MIN	FERMENT: 15–20 HR	YIELD: ABOUT 4 CUPS

INGREDIENTS

1 gallon pasteurized whole cow's milk

½ teaspoon mesophilic direct-set starter culture

4 tablespoons heavy cream

¼ teaspoon fine salt

1. In a double boiler, slowly heat the milk to 72 degrees.
2. Remove from heat and stir in the mesophilic starter culture.
3. Cover and place in an out-of-the-way place, wrapped in a towel to help keep the pot at 70 to 72 degrees.
4. Allow the curds to sit for 15 to 20 hours. They'll become firm during this time.
5. With a long, stainless-steel knife, cut the curds into 3⁄8- to ½-inch cubes and allow them to settle for 30 minutes.
6. In a double boiler, slowly heat the curds over 45 minutes, stirring every 5 minutes to prevent them from sticking together. Your goal is to raise the temperature to 110 degrees during this time.
7. Keep the curds at 110 degrees, and gently stir for 25 to 35 minutes more. The curds will start to firm up during this time.
8. Remove the pot from the heat and allow the curds to settle for 10 minutes.
9. Line a colander with cheesecloth and place it in a clean pot to drain for 10 minutes.
10. Tie the ends of the cheesecloth together and dip the curds into clean water three times to rinse and firm them.
11. Drain the cottage cheese again in the colander for 15 minutes more.
12. Place the drained curds into a clean bowl and gently stir in the cream and salt.
13. Refrigerate for two hours before serving.

Chevre (Goat Cheese)

COOK: 10 MIN	FERMENT: 60 HR	YIELD: 4 SMALL ROUNDS

INGREDIENTS

½ gallon pasteurized or raw goat milk (not ultra-pasteurized)

⅛ teaspoon MA4001 or similar freeze-dried, direct-set mesophilic culture

¼ teaspoon liquid calcium chloride mixed with 1 tablespoon water

⅛ teaspoon liquid rennet mixed with 1 tablespoon water

Flaked or kosher salt

1. Add the milk to a 3-quart, stainless-steel pot and slowly bring it to 86 degrees. Remove the warmed milk from the heat.
2. Sprinkle in the culture, wait 5 minutes, and then stir with 20 gentle strokes.
3. Add the calcium chloride-water mixture and stir gently.
4. Add the rennet mixture, stir, and cover. Let the mixture stand at about 72 degrees for at least 12 hours. Don't agitate or stir the mixture while the curd sets.
5. Place a draining rack inside the drain pan and place the forms onto the draining rack. Ladle the curd, which looks like thickened yogurt, into the forms. Allow the curd to drain for 24 hours at room temperature, pouring off the whey from the drain pan as needed to keep the cheeses above the liquid.
6. Remove the cheeses from the forms and place directly on the draining rack. Sprinkle on all sides with salt. Let the cheeses dry for another 24 hours at room temperature or refrigerate if it is especially warm weather, turning once or twice.
7. If desired, roll the cheeses in herbs before wrapping in wax paper, then wrap in plastic wrap. Refrigerate for up to several weeks.

NOTE: Direct set culture can be found at any cheesemaking supply store.

Mozzarella

PREP: 25 MIN	COOK: 30–40 MIN	YIELD: 2 POUNDS

INGREDIENTS

2 gallons whole raw or pasteurized milk (not ultra-pasteurized)

1 tablespoon citric acid, dissolved in ¼ cup water

½ teaspoon liquid rennet, mixed in ¼ cup water

½ teaspoon lipase powder, dissolved in ¼ cup water, and set aside for 10 to 20 minutes

Kosher salt

1. Using a double boiler, warm the milk to 55 degrees. Gently stir in the dissolved citric acid. Then stir in the dissolved lipase.
2. Slowly heat the milk to 88 degrees over low to medium heat. The milk will begin to curdle.
3. Stir in the rennet as you raise the temperature of the milk to 100 to 105 degrees. Within a few minutes, you'll begin to see more curds forming. After you reach the appropriate temperature, turn off the heat and remove the pan from the stove. When the whey is relatively clear, the curds are ready.
4. Remove the curds from the whey by either pouring them out through a strainer or ladling the curds into a bowl. Whichever method you choose, reserve the whey in a separate stock pot.
5. Begin the kneading process that will make the mozzarella nice and elastic. To do so, heat the reserved whey to 170 to 180 degrees. Wearing gloves, shape the curd into a ball, set the ball on the ladle, and submerge the ladle into the whey, dipping it as needed (you want the curd to be smooth and elastic in texture). Knead the curd again and re-submerge into the hot whey. Continue kneading and re-dipping the curd until it reaches 145 degrees, the temperature at which the curd will stretch.
6. When the curd is the right temperature (145 degrees), it's ready to be stretched. Sprinkle a small amount of kosher salt on the cheese (as you would seasoning food to flavor it) and then fold the salt into the cheese. Continue to knead and pull the cheese until it's smooth and elastic. When the cheese pulls with the consistency of taffy, it's done.
7. Shape the mozzarella into small or large balls. You can eat it while it's still warm, or you can place the balls in ice water for about five minutes to quickly bring the inside temperature of the cheese down. Hot or cold, the cheese is best served fresh. For storage, place the balls in a freezer bag with a few tablespoons of milk and keep refrigerated. Eat within a few days.

NOTE: Real mozzarella must come from buffalo milk. But this home version is fun to make and tastes wonderful.

Raising a Glass to Fermented Beverages

You can drink your fermented creations, too! Some are healthful creations full of probiotics and others are fun for the whole family to make and enjoy.

The dairy drink *kefir* is covered in the previous section of this chapter with other dairy ferments. Chapter 1 of this minibook is devoted to brewing your own beer, which also depends on the science of fermentation. This section gets you started with making other fermented beverages: ginger soda, root beer, and kombucha.

Here are some things each of your fermented drink recipes all have in common:

- Fermented drinks naturally become carbonated and fizzy.
- Fermented drinks are naturally full of living probiotics.
- Fermented drinks use starters such as yeast or kefir grains.
- Fermented drinks produce trace amounts of alcohol.
- The longer your drink ferments and sits out, the more sour, sweet, or vinegary its taste will become.
- Sweeten all your fermented drinks as you desire using honey or an alternative sugar.
- Be sure when bottling to leave some head space in the top or it could explode from fizzy-pressure.
- You can vary your recipes using different fruits or herbs.

Starting with starters

Starter cultures are the microorganisms that inoculate your fermented foods to help get the desired changes. The greatest role of the starter culture is its ability to speed up the fermentation process and get guaranteed results. Any culture starter will give your recipe added enzymes and flavors, change its texture, and add health benefits.

REMEMBER

Not all fermented foods require a starter culture. Be sure to check your recipe and see which ones do and do not.

For some recipes, you might use fermented grains, a yeast (plenty more on yeast in Chapter 1 of this minibook), or bacteria. No matter what starter culture you decide to use, starter cultures are easy to make. Starter cultures take time to grow, but you can save some time by purchasing starters pre-made from friends, at health food shops, or online. The beauty is that once you master making them, you can keep them for a long time and continue to use them to make more of your favorite fermented cultured foods.

Getting fizzy with it: carbonated drinks

It's hard to beat the satisfaction of making homemade carbonated drinks! You'll learn to love the fresh flavors and sodalike qualities. Making natural carbonated drinks at home is simple and easy to do, with the bonus of being healthy. You can control the amount of sugar you put in, and plus, they're far less expensive than store-bought sodas!

Ginger soda

Nothing beats a fresh bubbly ginger brew to wake up your senses! Ginger soda has several different steps but it's definitely worth the wait.

Root beer

Did you know that traditionally root beer was made using a tree called Sassafras? Today, many people use wintergreen and licorice root. Homemade root beer will give you a taste for the good ol' days and is full of herbal infusions.

Kefir

Kefir is said to originate in Eastern Europe and was a drink that originally began as a way to preserve milk. (See the previous section for a basic milk kefir recipe.) But there are non-dairy kefir alternatives, too. The sugar and bacteria in these liquids will create a bubbly and refreshing drink that is a bit sour, but great for the gut.

Kombucha

Kombucha has its roots in ancient Asian tradition but has become highly popular due to the health properties that captured the hearts and health of many.

Kombucha has a tangy, slight vinegary taste, but its base relies on unrefined sugar, water, and tea bags. It is said to have many detoxifying qualities and to give vitality; sometimes it is known as the *immortality elixir.* However, note that the base of this drink is unrefined sugar, which regardless of the other health benefits can still be bad in large quantities. But in small doses kombucha is said to increase digestibility, energy, and gut flora.

To make kombucha, you need a *SCOBY,* which stands for the symbiotic colony of bacteria and yeast. It is essential for kombucha making! Sometimes you will hear people use funny names for it, such as *the mother* because it is the source of life for kombucha, or *a mushroom* because it turns into a big, gelatinous, bacterial component that can resemble a fungus.

A healthy SCOBY can take on a range of appearances. It may be smooth or bumpy and lumpy. It may have holes in it or stringy remains from the culture. It may be ragged and misshapen. It can sink to the bottom of the brewing solution, float on top, or hover in the middle. All can be perfectly normal.

WARNING

The main thing to look out for is any mold. Mold is rare but dangerous. If you see any signs of blue or black mold on your SCOBY, throw away the SCOBY and the kombucha. You can use the same container again, but just ensure that you clean it out well!

Here are some tips to keep in mind when making kombucha:

- Plain white, black, or green tea work for kombucha.
- Use a fresh SCOBY to get your best results.
- Choose a wide-mouth jar. Your SCOBY will grow big and form to your jar! With every new batch you make, you will see your SCOBY reproduce and get thicker. It will make SCOBY babies.
- Avoid brewing your kombucha for too long, but leave it long enough so it turns from too sweet to just sour enough.
- Although refined white sugar is the best for kombucha to digest, try to use cane sugar or unrefined for better health.
- Avoid plastic or metal objects to make it! Kombucha needs glass and wood as it becomes highly acidic.

Ginger Soda

PREP: 5 MIN	FERMENT: 48–72 HR	YIELD: 1 GALLON

INGREDIENTS

Filtered water

Ginger root

Unrefined sugar such as cane or Sucanat

⅓ cup lemon juice

1. **Make the starter for your soda:** Fill a 4-cup jar with water, about two-thirds of the way full.
2. Grate the ginger, enough for 1 heaping tablespoon. Do not remove the skin. You will also need ⅓ cup of ginger later for the wort; feel free to grate that now. Place the 1 tablespoon of grated ginger into the jar of water.
3. Stir in 1 large tablespoon of sugar and lemon juice until it is dissolved.
4. Place cheesecloth and a rubber band on your jar — you want to allow some breathing room out but prevent bacteria or dust from coming in.
5. Place the jar in a warm place. The ideal temperature is 75 to 85 degrees for the jar to ferment. Insulate and cover the jar. (You can use cloth towels to surround and cover it.) Allow the jar to rest and work its fermentation magic!
6. Stir your starter once a day for three to seven days. Taste and add ginger and sugar as desired to taste! Once you begin to see bubbling, the starter is nearing its finish.

---

1. **Make the wort, or pre-fermented liquid:** Fill a gallon jar with approximately 10 cups of water, or two thirds of the way full.
2. Add ⅓ cup of grated ginger and 1½ cups sugar to the jar of water. Stir well!
3. Take 1 cup from your starter recipe and stir it into the jar.
4. Stir in the remaining ⅓ cup of lemon juice. Stir again until all the sugar is dissolved.

(continued)

5. Cover the jar with cheesecloth and a rubber band. Let the jar sit in a warm location, or cover with towels in room temperature. Let your wort rest.

6. Stir once or twice a day for three to seven days. Once you achieve the soda taste you desire, bottle or store your homemade soda in the fridge!

TIP: Taste your wort once in a while. Is it sweet and gingery as you desire? Add water, sugar, or ginger as desired. Is your soda fizzing? Add more starter if you need to!

TIP: Always buy fresh ingredients where you can. Ginger root fresh from the market will give you the best flavors for this soda recipe.

Root Beer

PREP: 25 MIN	FERMENT: 48–72 HR	COOK: 30–40 MIN	YIELD: APPROX. 18 CUPS

INGREDIENTS

8 cups water

20 inches sassafras root

1 piece vanilla bean, 3 inches long

1¾ cup brown sugar or Sucanat

⅛ teaspoon ale yeast

¼ cup lukewarm water

1 Bring 8 cups of water to a boil and stir in the sassafras and vanilla bean. Let the pot stay uncovered.

2 Reduce the heat to simmer the roots for 15 to 20 minutes. You will notice the water begin to turn red in color. It should also smell delicious! Smell and color not strong enough? Add more roots!

3 Stir in the unrefined sugar until it dissolves.

4 Let the liquid cool to room temperature.

5 Drain the roots and vanilla bean through a cheesecloth or thin-meshed strainer, placing the infused liquid into a large jar or pitcher.

6 In a separate cup, combine the yeast and ¼ cup of lukewarm water. Let it sit about five minutes.

7 Add the yeas -liquid to the jar. Close the jar and shake it around to get the yeast going throughout the liquid.

8 Bottle your root beer! (Best to use flip-top bottles.)

9 Store at room temperature, or in a cool dark room.

10 Watch your homemade root beer bubble and fizz over two to three days.

11 After you have enough carbonation in your drink and are satisfied, refrigerate!

VARY IT! Try adding other interesting roots and herbs in your root beer recipe for added flavors. Some people like to try licorice root, ginger root, and juniper berry, some wintergreen for some minty freshness, or even wild cherry!

Vanilla Cinnamon Coconut Kefir

PREP: 15 MIN	FERMENT: 48–72 HRS	YIELD: 2 CUPS

INGREDIENTS

2 cups coconut kefir

½ teaspoon fresh vanilla bean powder

1 tablespoon honey or maple syrup

¼ teaspoon cinnamon

1. Mix all of your ingredients together into a jar.
2. Cover your glass jar with lid, a towel or cloth napkin and let the magic work from 12 to 36 hours.
3. Be sure to check the coconut kefir every few hours and remember to always remove the kefir grains as soon as it reaches the texture and taste you desire.
4. Close your glass jar with the lid and place your delicious kefir in the fridge.

Green Tea Kombucha

PREP: 20 MIN	FERMENT: 5–10 DAYS	YIELD: 12 CUPS

INGREDIENTS

6 green tea bags

1 cup sweetener of choice, preferably unrefined sugar

3 or 4 liters water

A kombucha SCOBY

1–2 cups of raw apple cider vinegar or leftover kombucha

1. In a large pot, combine the tea bags, sugar, and 2 to 3 cups of water.
2. Bring to a simmer and remove from heat.
3. Cover and let the green tea bags steep for 10 to 15 minutes.
4. Add 2 cups of cool water to bring the tea temperature down.
5. Place the SCOBY and finished kombucha or raw apple cider vinegar in your large gallon jar.
6. Add cooled-down tea to the jar.
7. Use a wooden spoon (do not use metal) to help the SCOBY float at the top. It's okay if it is sinking, but it should rise during fermentation.
8. Cover the jar with a paper towel or cheesecloth, and secure with a rubber band.
9. Let the liquid ferment at room temperature for 5 to 10 days.
10. Taste to see if it is not too sweet and if it is fizzy enough. Sweeten as desired to your taste!
11. When the kombucha is well carbonated and has a slight vinegary smell, pour the kombucha through a strainer into a clean jar or jug.
12. Be sure to leave the SCOBY and approximately 1 or 2 cups of finished kombucha behind. This is your starter for a second batch of tea!
13. Refrigerate it to prevent it from souring any more or if needed, keep it at room temperature for a few days to build up more carbonation.

TIP: Don't let your kombucha build up carbonation too long or it could explode when bottled. Also, the longer kombucha sits out, the more sour and vinegary its taste will become.

Honey Kombucha

PREP: 20 MIN | FERMENT: 5–10 DAYS | YIELD: 12 SERVINGS

INGREDIENTS

6 green or black tea bags

12 cups water

1 cup raw honey or unrefined sugar such as Sucanat

Kombucha SCOBY

1–2 cups raw apple cider vinegar or leftover kombucha

1. Combine the tea bags and a few cups of water in a large pot.
2. Bring the water to a simmer, and remove from heat.
3. Stir in the honey until it is dissolved.
4. Cover and let the green tea bags steep for 10 to 15 minutes.
5. Add 8 cups of cool water to the pot to cool down the tea.
6. Place the SCOBY and raw apple cider vinegar in your large gallon jar.
7. Add your now cooled-down tea to the jar.
8. Use a wooden spoon (metal will harm your bacteria) to help the SCOBY float at the top. If it does not rise, it should rise during fermentation!
9. Cover the jar with cheesecloth or a paper towel, and secure with a rubber band. Let ferment at room temperature for 5 to 10 days.
10. Check on it and taste it! Is it tangy, sweet, and fizzy enough?
11. Pour the kombucha through a strainer into a clean large jar or several bottles. (In this case, leave the SCOBY and 1 to 2 cups of finished kombucha behind for your next batch!)
12. When you have the taste you desire, refrigerate!

VARY IT! Want some new flavors in your kombucha? Kombucha can be made with a wide range of added flavors! Try adding a slice of ginger, or throw a few juniper berries into your next batch!

IN THIS CHAPTER

- **Working with yeast to make classic bread recipes**
- **Adding to the menu with quick breads, muffins, and biscuits**

Chapter 3

Baking Bread

Many people get nervous about baking bread from scratch, thinking that you have to have some secret talent to make it rise or come out tasting good. And because bread is so readily available and such a staple for many people, picking up a loaf at a local grocery store or bakery is much easier than making your own from scratch.

Although no one is suggesting that you'll *never* pick up another store-bought loaf, in this chapter you discover that making your own bread is deeply satisfying yet simple. From the relaxing repetition of kneading the dough to the slow, quiet rise to the shaping of the loaves and the heavenly smell of it baking in the oven . . . nothing is quite like it.

And for homesteaders trying to become more self-sufficient, baking bread at home is a skill that saves money and delights family and friends. In addition, homemade bread is a wonderful way to use some of the fruits and veggies you've grown as well as honey straight from your backyard bees!

Understanding Yeast Breads

Entire books have been dedicated to the art of breadmaking, and there are hundreds of different techniques and doughs that you can bake. Instead of overwhelming you with too much information, we'll cover just the basics, to lay a good solid foundation upon which you can build your bread-baking knowledge. When you feel comfortable with the mixing, kneading, and rising of basic bread doughs, you can move on to fancier types of loaves and rolls. First, you need to know how all the ingredients work together, in order to have a better understanding about the making of bread.

Yeast

Yeast is the ingredient that makes bread rise. It's a live plant, which, when dissolved in warm water (no more than 110 degrees) and given something to eat, becomes active. Yeast needs food to stay alive. Generally, the sweetener (usually sugar or honey) added to the dough is the yeast's initial food. When the bread is kneaded, more sugar is made in the starch from the flour, which sustains the yeast until it finally dies when it's baked in the oven.

You'll see different types of yeast when shopping, including bread machine yeast, compressed cake yeast, and brewer's yeast. For our purposes, we stick with active dry yeast.

Active dry yeast has a longer shelf life and is easier to store than fresh compressed cake yeast. It's available in foil packs or jars coded with an expiration date. One package of active dry yeast contains 1 scant tablespoon (*scant* means "barely"), so if you don't have yeast in the premeasured packages, measure out 1 level tablespoon and gently shake back just a little.

REMEMBER

To ensure that your yeast stays fresh for as long as possible, store it in the refrigerator until you're ready to use it.

Yeast likes to be snug and warm, but not hot. The most common mistake that first-time breadmakers make is to kill the yeast by overheating it. One of the first steps in breadmaking is to dissolve the yeast in warm water- sometimes a temperature is given (not over 110 degrees). How can you tell if the water temperature is correct? The most accurate way is to use a thermometer. If you don't have one, you can measure the temperature almost as accurately by feel. Your body temperature is about 98.6 degrees, so run the hot water until it's just slightly warm to the touch, but not uncomfortable.

Flour

Flour is the main ingredient in bread. Flours made from wheat contain proteins that, when liquids are added and the dough is kneaded, form gluten. This gluten gives the dough its elasticity, allows the dough to stretch as it traps the gases released by the yeast, and causes the bread to rise. The different varieties of flour that are made from wheat have different amounts of gluten-making proteins, so it's good to know a little about your choices for breadmaking.

- **All-purpose enriched white flour:** A mix of hard and soft wheats, this flour is the most common. Because it is *all-purpose,* it's a good flour to have around if you want to make a cake, bread, or cookies, but the results may not be as good as if you chose a flour specifically intended for each purpose (cake flour for cakes and bread flour for bread).
- **Bread flour:** Bread flour is protein-rich white flour made from hard wheat. It's a good choice for breadmaking because it's a gluten-rich flour that makes a good, elastic dough and gives good volume when your bread rises. Loaves made with bread flour are likely to be a bit tastier, lighter, and better risen than those made with all-purpose flour.

  WARNING

  Bread flour absorbs more liquid than all-purpose flour, so you may need less flour if your recipe calls for all-purpose flour and you're using bread flour instead.
- **Self-rising flour:** This flour is all-purpose flour with salt and baking soda mixed in it. It is not recommended for yeast breads.
- **Unbleached white flour:** Unbleached flour is a mixture of hard and soft wheats and has not been chemically whitened (such as all-purpose). It has a slightly higher protein content and contains more nutrients though, making it a good choice for baking bread.
- **Whole-wheat flour:** Commercial whole-wheat flour is milled to include the flour, bran, and germ of the wheat. If a recipe calls for white flour and you want to use whole wheat, try substituting whole-wheat flour for half the amount of white flour.

WARNING

Whole-wheat flour produces a much denser loaf of bread and absorbs more liquid than white flour, so if you're substituting whole-wheat flour for white flour, add the minimum amount of flour called for in the recipe and then continue to add more slowly to make sure that you don't toughen the dough.

Sweeteners

The usual sweeteners you find in breadmaking are sugar and honey. Although the sweetener typically doesn't make the bread sweet like a cake, it does add some flavor and feed the yeast. When the yeast eats the sugar, it begins a fermentation process, which produces the gases that cause the bread to rise. The sweetener also browns during baking, which helps produce a bread with a nice texture and golden-brown crust.

Salt

Salt is quite important in baking bread. It adds flavor, controls yeast growth, and prevents overrising. Don't overdo it, though, or the salt will inhibit the proper growth of the yeast. Just use the amount called for in the recipe.

Fat

Fat in bread recipes adds to the tenderness and texture of the bread. Fats are also flavor carriers and act as natural preservatives, helping your loaf retain its moisture and stay mold free. Butter adds a bit of color, but you can substitute shortening or lard for butter measure for measure. Some recipes also use vegetable or olive oil.

Eggs

Eggs are not essential to breadmaking, but some recipes call for them. The addition of eggs produces a richer dough and gives the dough a lovely pale-yellow color. And you have plenty of eggs from your backyard flock, right?

Liquids

The liquid in a bread recipe moistens the flour, which activates the gluten. It also can feed the yeast. Typical liquids found in bread recipes are water, milk, and buttermilk. Water gives bread a brown, crisp crust. Milk gives a velvety, creamy texture to the bread. Buttermilk adds a nice tangy flavor. Yeast dissolves a bit more slowly in milk than in water.

TIP

If you use milk or buttermilk, warm it slightly (so that it's warm to the touch) to remove the chill of the refrigerator before dissolving the yeast in it.

Mixing and Kneading Breads

Typically, a recipe calls for you to dissolve the yeast in a liquid and then add several other ingredients (butter, salt, and sugar) to the yeast. Then you add the flour.

You can mix doughs in two ways: with a mixer with a dough hook or by hand. Either way, adding the flour slowly is important. The first 2 to 3 cups will be absorbed quickly into the dough, making a wet, loose batter. Then you start adding the flour in ½-cup intervals and continue mixing until the dough starts to come away from the sides of the bowl.

If you have a sturdy mixer with a good motor, using it is the easy way to mix bread dough. If you're using a mixer with a dough hook attachment, knead the dough for about five minutes on medium speed. Remove the dough from the bowl and finish kneading by hand on a lightly floured surface.

Mixing bread dough by hand is a little more work, but it has its rewards. When the dough comes away from the sides of the bowl, turn the dough out onto a lightly floured surface. A large wooden cutting board, a clean countertop, or a large slab of marble makes a good kneading surface. Just make sure that it's dry, and then lightly dust it with flour. Also, rub your hands with a little flour to keep the dough from sticking to them.

Follow these simple steps to knead dough by hand like a pro:

1. **Turn the dough onto a lightly floured surface.**
2. **Dust the top of the dough with flour.**

   Don't use more than a tablespoon or two of flour for each dusting.
3. **Press the heels of your hands into the top of the dough.**

   You need to use some arm strength, so lean into the dough and push the dough hard into the kneading surface. Linking you fingers together, one hand on top of the other, may increase your kneading strength.
4. **Fold the dough in half toward you and press down again with the heels of your hands.**
5. **Give the dough a quarter turn, fold it again, and continue the pushing and kneading with the heels of your hands, always turning the dough and folding it so that all the dough gets worked.**
6. **Continue to lightly dust the dough if it sticks to the board or your hands.**

   Keep up the kneading process for about ten minutes (three to five minutes if you've used a mixer). If you're kneading by hand, it's unlikely that you'll overwork the dough.

Kneading is an important step in good breadmaking, so don't cut corners. If you get tired and need to rest, that's okay. Just cover the dough with a clean dish towel and rest for five minutes. The dough will be glad to rest, too. You'll know you're done when your dough is smooth, elastic, and a bit satiny. If you press into the dough and it springs back, you've done the job correctly. Figure 3-1 shows kneading in action.

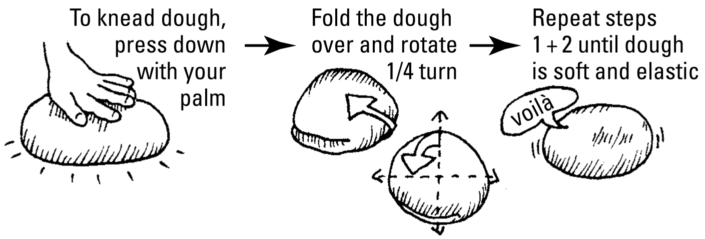

To knead dough, press down with your palm
Fold the dough over and rotate 1/4 turn
Repeat steps 1 + 2 until dough is soft and elastic
voilà

FIGURE 3-1: Kneading bread dough by hand.

Encouraging Bread to Rise

After you've finished kneading, it's time to set the bread aside to rise. Ceramic bowls are good insulators. Metal or glass bowls may fluctuate with the exterior temperature, but you can use them if you want. Yeast rises best when it's cozy warm, so preheat your bowl by rinsing it out with warm water and drying it thoroughly. Then generously grease the inside of the bowl with softened butter, margarine, or even shortening (just don't use oil).

To increase the chances of your bread dough rising sufficiently, follow these steps:

1. **Form the dough into a ball and place it in the bowl.**
2. **Turn the dough once around the bowl to grease the dough itself.**
3. **Dampen a clean dish towel with warm water and drape it over the top of the bowl.**

The purpose of the cover is to keep the dough draft-free and prevent anything from entering the dough as it rises, but the dough also needs to breathe, so you don't want to seal it off from air.

TIP

Many cooks agree that the best place to let dough rise is in a gas oven, turned off. The heat that the pilot light gives off creates the perfect cozy spot for bread to rise, and the oven itself should be draft-free. The microwave oven, if it's large enough, is also a good, draft-free choice. Of course, the kitchen countertop is fine, too.

REMEMBER

The dough needs to double in size, which usually takes 1 to 1½ hours. Always check it after the minimum amount of time. If you're using rapid-rise yeast, check it after 30 to 40 minutes.

You'll know that your bread has finished rising when you can poke your finger about ½ inch into the dough and the indentation stays. If it springs back, continue letting it rise. Don't allow the dough to more than double in size. If a recipe calls for a second rising, literally punch down the dough, give it a few quick turns in the bowl, re-cover the bowl, and allow the dough to rise again.

If you're going to shape the dough into loaves, punch down the dough and turn it out onto a lightly floured board. Knead the dough again for two to three minutes. Then divide the dough, if necessary, into the portions you need, letting the dough rest for about five minutes before shaping the loaves.

Shaping and Baking the Loaves

If you're making two loaves of bread from one batch of dough, pat or roll the dough out into a rectangle slightly shorter than the loaf pans. Fold the dough in thirds like a letter or roll it up like a jelly roll. Tuck the ends under and place it seam side down into the prepared loaf pan, as shown in Figure 3-2. Cover and allow the bread to rise until it just comes up to the side of the pan.

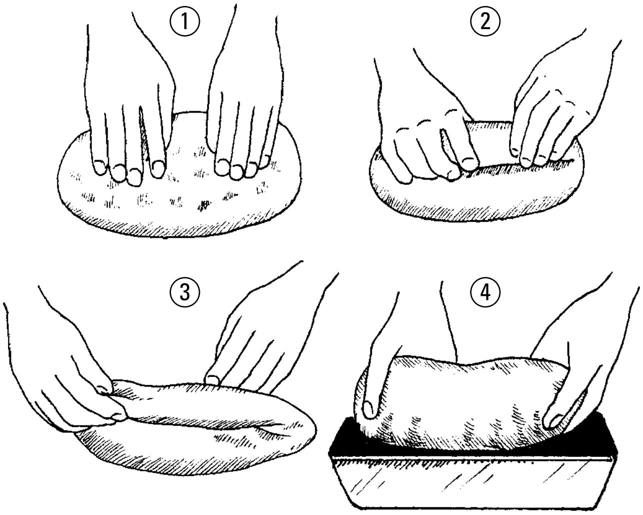


FIGURE 3-2: Preparing dough for a loaf pan.

In the first 15 or so minutes of baking, you'll discover that your bread has a growth spurt during which the yeast gets really active and pushes up the bread before the crust begins to set. Always account for this sudden growth spurt by not allowing your bread to rise over the top of the pan during the second rising time. When the dough gets pretty close to the top of the pan — but not over — it's time to get your loaf in the oven.

Always bake your bread in a preheated oven. Usually, the baking time given for a recipe is accurate, but if you're unsure, give a thump on the bread (watch out, it will be hot!). If it sounds hollow, it's finished. If you still aren't sure whether it's done, you can go ahead and insert a long wooden skewer into the middle of the loaf. If it comes out clean, your bread is finished. Don't judge doneness by the color of the loaf. If you find that your bread is browning too quickly, cover it with aluminum foil for the last 15 or 20 minutes of baking.

Turn the bread out of the pans onto cooling racks when you remove them from the oven. They should slip out easily. If you want a soft crust, you can brush the top with melted butter.

Let the bread cool for at least 30 minutes before you slice it; otherwise, you run the risk of ruining the bread you've worked so hard to make. If you cut it too soon, the center will be gummy, and the bread will not be set enough to cut and can taste doughy.

Yeast Bread, Quick Bread, Muffin, and Biscuit Recipes

Yeast breads are some of the most satisfying foods you can bake. Few things are as welcoming as a home filled with the aroma of freshly baked bread. Quick breads are quite popular because they're a snap to put together and can satisfy either a sweet or a savory desire. Because they're leavened with baking soda or baking powder, they don't require the rising time yeast breads do, which means they're fast and easy to make.

This section features recipes for several yeast breads as well as a few quick bread options. From full loaves to individual servings and from savory to sweet, there's something here that will complement most any meal.

Basic White Buttermilk Bread

PREP: 25 MIN	RISING: 90 MIN	BAKING: 35 MIN	YIELD: 2 LOAVES (ABOUT 24 SERVINGS)

INGREDIENTS

¼ cup warm water (not above 115 degrees)

1 package active dry yeast

2 tablespoons sugar

¼ cup (½ stick) butter, melted and cooled to lukewarm

2 cups buttermilk, at room temperature

5 to 6 cups bread flour

1 teaspoon salt

¼ teaspoon baking soda

1. In a large mixing bowl, combine the water, yeast, and sugar. Stir with a whisk to dissolve the yeast. Add the melted butter to the buttermilk and mix it into the yeast mixture.
2. In a separate bowl, mix together 5 cups of the flour, the salt, and the baking soda; mix it into the yeast mixture to form a dough (add up to 1 cup additional flour, if necessary).
3. Knead the dough on a lightly floured surface until smooth and elastic, about 10 minutes.
4. Place the dough in a buttered bowl, cover, and set it in a warm place to rise until doubled, about 1 hour
5. Grease two 9-x-5-inch loaf pans. Punch down the dough and knead it again for about 1 minute. Divide the dough in half and shape it into two loaves. Place them in the prepared pans, cover, and let rise in a warm place until the dough just barely reaches the edge of the pan, about 30 minutes.
6. Preheat the oven to 350 degrees. Bake the bread until it’s browned and crusty, about 35 minutes. Cool the bread on wire racks.

TIP: If you don’t have buttermilk on hand, you can substitute whole milk.

TIP: This bread is excellent toasted or fried as French toast.

PER SERVING: *Calories 100 (From Fat 17); Fat 2g (Saturated 1g); Cholesterol 4mg; Sodium 99mg; Carbohydrate 17g (Dietary Fiber 1g); Protein 3g*

Honey-Oatmeal Bread

PREP: 45 MIN

RISING: 90 MIN

BAKING: 35 MIN

YIELD: 2 LOAVES (ABOUT 24 SERVINGS)

INGREDIENTS

2 cups simmering water

1 cup quick-cooking oatmeal (not instant)

2 tablespoons butter

1 package active dry yeast

½ cup warm water (not above 115 degrees)

¾ cup honey or maple syrup

5 to 7 cups flour

2 teaspoons salt

1. Combine the water, oatmeal, and butter in a small bowl and let stand until it's cool to the touch, about 30 minutes.

2. In a small bowl, combine the yeast, warm water, and honey or maple syrup. Stir to dissolve and let stand for about 5 minutes (the water should be foamy).

3. Measure 5 cups of the flour and the salt into a mixing bowl. Add the oatmeal and yeast mixture and stir, adding more flour if necessary, until the mixture forms a kneadable dough (add up to 2 cups additional flour, if necessary).

4. Knead the dough on a lightly floured surface, adding more flour if the dough gets sticky, until the dough is smooth and elastic and springs back when you touch it, about 10 minutes.

5. Place the dough in a buttered bowl, cover, and set in a warm place to rise until doubled, about 1 hour.

6. Grease two 9-x-5-inch loaf pans. Punch down the dough and knead it again for about 1 minute. Divide the dough in half and shape into two loaves. Place them in the prepared pans, cover, and let rise until the dough barely reaches the edges of the pans, about 30 minutes.

7. Preheat the oven to 375 degrees. Bake the bread until it's browned and crusty, about 35 minutes. Cool the bread on wire racks.

TIP: Whenever you serve oatmeal for breakfast, it's easy to have a lot left over. Don't waste it: Incorporate it into a loaf of bread!

PER SERVING: *Calories 112 (From Fat 10); Fat 1g (Saturated 1g); Cholesterol 2mg; Sodium 146mg; Carbohydrate 23g (Dietary Fiber 1g); Protein 3g*

Jeff's Potato Bread

PREP: 35 MIN

RISING: 90 MIN

BAKING: 35 TO 45 MIN

YIELD: 2 LOAVES (ABOUT 24 SERVINGS)

INGREDIENTS

1 package active dry yeast

½ cup lukewarm water (not above 115 degrees)

½ cup plus 1 teaspoon sugar

1 cup milk, warmed (not above 115 degrees)

1 cup warm mashed potatoes (instant is okay)

½ cup shortening, melted and cooled

2 eggs, beaten

2 teaspoons salt

6 to 7 cups bread flour

1 Dissolve the yeast in the warm water with 1 teaspoon of the sugar and let stand for about 10 minutes.

2 In a large mixing bowl, combine the warm milk with the mashed potatoes and shortening. Add the beaten eggs to the potato mixture. Add the yeast mixture and stir to combine. Add the ½ cup sugar and the salt to the mixture. Mix in enough flour to make a kneadable dough.

3 Knead the dough on a lightly floured surface until it is smooth and elastic, adding additional flour if the dough gets sticky, about 10 minutes. Place the dough in a buttered bowl, cover, and set it in a warm place to rise until doubled, about 1 hour.

4 Grease two 9-x-5-inch loaf pans. Punch down the dough and knead it again for about 1 minute on a lightly floured surface. Divide the dough in half and shape it into two loaves. Place the loaves in the prepared pans, cover, and let rise until the dough barely reaches the tops of the pans, about 30 minutes.

5 Preheat the oven to 350 degrees. Bake the bread until it's browned and crusty, 35 to 45 minutes. Remove the loaves from the pans and cool on wire racks.

PER SERVING: *Calories 150 (From Fat 39); Fat 4g (Saturated 1g); Cholesterol 15mg; Sodium 171mg; Carbohydrate 24g (Dietary Fiber 1g); Protein 4g*

Fluffy Dinner Rolls

PREP: 30 MIN
RISING: 90 MIN
BAKING: 30 TO 40 MIN
YIELD: ABOUT 2 DOZEN

INGREDIENTS

6 to 7 cups flour

6 tablespoons sugar

1¼ teaspoons salt

1 package active dry yeast

2¼ cups warm water (not above 115 degrees)

3 tablespoons vegetable oil

1. In a large mixing bowl, combine 6 cups of the flour, 5 tablespoons of the sugar, and the salt.

2. In a medium-sized mixing bowl, dissolve the yeast and the remaining 1 tablespoon sugar in the warm water. Let stand for about 5 minutes until the top gets a bit foamy. Stir in the vegetable oil. Slowly add the yeast mixture to the flour mixture and mix until it's thoroughly incorporated.

3. Remove the dough from the bowl and knead, adding the remaining cup of flour if the dough gets sticky, and kneading until the dough is smooth and satiny and springs back when you touch it, about 10 minutes.

4. Place the dough in a large buttered bowl. Cover and let rise in a warm place until the dough has doubled in bulk, about 1 hour.

5. Punch down the dough and knead it for about 1 more minute. Pinch off enough dough to make a 1½-inch ball. Roll the dough into a ball and place it in a greased 13-x-9-inch baking pan. Repeat with the remaining dough until you have about 24 balls. They can touch each other in the pan and fit snugly against the sides. Cover and let rise until doubled in bulk, about 30 minutes.

6. Preheat the oven to 350 degrees. Bake the rolls for about 30 to 40 minutes, until golden brown and fluffy.

NOTE: The water you use should be only slightly warmer than your body temperature.

TIP: Brush the tops of the rolls with melted butter before baking them for a tender crust.

PER SERVING: *Calories 143 (From Fat 18); Fat 2g (Saturated 0g); Cholesterol 0mg; Sodium 122mg; Carbohydrate 27g (Dietary Fiber 1g); Protein 4g*

Amish Applesauce Bread

PREP: 15 MIN	BAKING: 50 TO 60 MIN	YIELD: 12 TO 14 SERVINGS

INGREDIENTS

2 cups all-purpose flour

1 teaspoon baking powder

1 teaspoon salt

1 teaspoon baking soda

1 teaspoon ground cinnamon

½ teaspoon ground nutmeg

½ cup (1 stick) butter, softened

¾ cup sugar

2 eggs

1 teaspoon vanilla extract

1 cup applesauce

½ cup walnuts, chopped (optional)

1 Preheat the oven to 350 degrees. Grease a 9-x-5-inch loaf pan.

2 In a medium bowl, sift together the flour, baking powder, salt, baking soda, cinnamon, and nutmeg.

3 In a separate mixing bowl, cream together the butter and sugar. Beat in the eggs and vanilla.

4 Gradually add the dry ingredients to the creamed butter. Stir in the applesauce and, if desired, the walnuts, mixing just enough to blend all the ingredients.

5 Pour the batter into the prepared pan. Bake for 50 minutes to 1 hour, until a toothpick inserted into the center comes out clean. Cool the loaf on a wire rack for 10 minutes before removing from the pan to finish cooling.

PER SERVING: *Calories 215 (From Fat 79); Fat 9g (Saturated 5g); Cholesterol 56mg; Sodium 343mg; Carbohydrate 31g; (Dietary Fiber 1g); Protein 3g*

Southern Corn Bread

PREP: 10 MIN

BAKING: 20 MIN

YIELD: ONE 8- OR 9-INCH CORN BREAD

INGREDIENTS

2 tablespoons butter or vegetable oil

2 cups finely ground cornmeal

4 teaspoons baking powder

1½ teaspoons salt

1½ cups buttermilk

1 egg, lightly beaten

1. Preheat the oven to 450 degrees. Place the butter or vegetable oil in the bottom of an 8- or 9-inch square baking pan (or a 10-inch cast iron skillet) and place it in the oven while it heats for about 3 minutes (if you're using butter, keep an eye on it to make sure it doesn't burn).

2. In a large bowl, combine the cornmeal, baking powder, and salt.

3. In a separate bowl, mix together the buttermilk and egg and add it to the cornmeal mixture. Stir just to combine; do not overmix.

4. Pour the batter into the preheated skillet or pan and bake for about 20 minutes, until a knife inserted into the center comes out clean. Cool the corn bread in the skillet for 20 minutes before serving.

PER SERVING: *Calories 120 (From Fat 27); Fat 3g (Saturated 2g); Cholesterol 24mg; Sodium 456mg; Carbohydrate 19g (Dietary Fiber 2g); Protein 4g*

Blueberry Muffins

PREP: 15 MIN	BAKING: 20 MIN	YIELD: 24 MUFFINS

INGREDIENTS

2 cups all-purpose flour

2 teaspoons baking powder

1 cup sugar

½ cup (1 stick) butter, melted

½ cup milk

1 teaspoon vanilla extract

2 eggs, lightly beaten

2½ cups blueberries, fresh or frozen (not packed in syrup)

1. Preheat the oven to 400 degrees. Grease or line two 12-cup muffin cups.

2. In a small bowl, combine the flour and baking powder; set aside.

3. In a large mixing bowl, combine the sugar, butter, milk, vanilla, and eggs. Mix to combine.

4. Slowly add the flour mixture to the sugar mixture and stir just to moisten the dry ingredients. Fold in the blueberries just to combine. Don't overmix.

5. Fill the muffin cups three-quarters full of batter. Bake (both pans side by side is okay) for 20 minutes or until golden brown. A wooden toothpick inserted into the center of the muffins will come out clean when the muffins are done. Let the muffins rest for 5 minutes on the cooling rack before removing them from the pan.

NOTE: The secret to bumpy, rounded muffin tops and a moist interior is to avoid overmixing the dough and to use only a bowl and a spoon for mixing. Don't use a handheld or stand mixer. When you combine the flour mixture with the liquids, just give it a few (no more than five) good turns with a sturdy wooden spoon. A tiny bit of unmixed flour should remain in your batter, and that's okay. The batter will finish mixing in the oven, and the unmixed flour will not be present in the muffin.

TIP: If you don't user liners, grease only the bottoms of the muffin cups (the sides of the cup should be left ungreased). Not greasing the sides gives you a better-shaped muffin.

PER SERVING: *Calories 122 (From Fat 41); Fat 5g (Saturated 3g); Cholesterol 29mg; Sodium 41mg; Carbohydrate 19g (Dietary Fiber 1g); Protein 2g*

Buttermilk Biscuits

PREP: 15 MIN | BAKING: 10 TO 12 MIN | YIELD: 16 BISCUITS

INGREDIENTS

2 cups White Lily brand soft white flour or cake or all-purpose flour

¼ teaspoon baking soda

1 teaspoon baking powder

1 teaspoon salt

Pinch of sugar

6 tablespoons cold butter, cut into 6 pieces

¾ cup buttermilk

1 Preheat the oven to 425 degrees.

2 Add the buttermilk and mix until just moistened.

3 Pat out the dough onto a lightly floured surface until it is about ½-inch thick. Cut the dough into 2-inch circles (use a drinking glass or cookie cutter). Gather up the scraps and pat them out again. Place biscuits on an ungreased baking sheet.

4 Bake until just light brown, for 10 to 12 minutes. Serve hot.

NOTE: Biscuits are a lot like pie pastry in that too much handling will toughen the dough, and the biscuit won't be as delicate. Because you don't want to overmix your biscuit dough, working efficiently when making biscuits is important.

NOTE: Steam is a powerful leavener for biscuits, so it's okay if your biscuits are a bit moist when you roll them out. Don't over-flour the dough to make it easier to handle. Just pat out the dough, cut it with a cookie cutter, and then place the biscuits on a baking sheet.

TIP: If you want biscuits with soft sides, place them in the pan so their sides are touching. If you want them to have crusty sides, place them about an inch apart on the baking sheet.

PER SERVING: *Calories 100 (From Fat 41); Fat 5g (Saturated 3g); Cholesterol 12mg; Sodium 249mg; Carbohydrate 13g (Dietary Fiber 0g); Protein 2g*

IN THIS CHAPTER

- » **Making rolled, molded, or dipped candles**
- » **Custom-creating your own soaps**

Chapter 4

Making Candles and Soap

For many homesteaders, the drive to become increasingly more self-sufficient is strong. And it predictably leads to adding new skills and embarking on new experiments to see whether just a little bit more can be produced independently, to find the next thing that doesn't have to be bought conventionally.

Let's say you're growing your own vegetables, creating rich compost for the garden, getting fresh eggs from chickens you're raising yourself, and harvesting honey from your own colony of backyard bees. Perhaps you're canning and pickling some of that produce, trying your hand at techniques such as fermenting and dehydrating. Maybe you've even started brewing your own beer, making your own wine, and baking bread from scratch.

From there, it's just a short hop to making your own candles and soap. And when many homesteaders feel the urge to branch out to "the next thing," this is often one of the things they land on.

This chapter ushers you in to the hobby of making your own candles and soap as a way to save money, be more self-sufficient, or just create useful and beautiful homemade items that you'll use often.

Igniting Your Candlemaking Hobby

Making candles can be a relaxing and rewarding hobby. Nothing quite compares to the feelings of pride and pleasure that come from looking at a beautiful, burning candle and knowing that you created it with your own two hands. And because candlemaking isn't an expensive hobby, you can decorate your home with candles, as well as give them as gifts.

Waxing about the types of waxes

Without wax, your candle won't burn. But certain waxes are more appropriate for certain types of candles.

Paraffin wax: The winner and still champion

Paraffin wax is a petroleum-based wax and the most popular wax for making candles. If you're new to candlemaking, paraffin wax makes a great starting point. Paraffin wax is inexpensive, easy to color, and available practically anywhere. It has a colorless and odorless nature that enables you to easily add and reliably predict your end colors and aromas. Paraffin wax is commonly available in chunks and large slabs.

WARNING

Don't be tempted to do one-stop shopping and buy your paraffin wax at the grocery store. This wax isn't the type you use in candlemaking; instead, it's used for sealing food that you've jarred.

Beeswax: No stings attached

A popular choice, *beeswax* is an all-natural product that has a pleasant honey aroma when burned. In addition to its natural golden shade, beeswax is available in white and other colors. You can buy beeswax in honeycomb sheets, blocks, or beads. If you have your own backyard colony of bees, you can harvest the honeycombs right out of your hive.

Beeswax's low melting point (approximately 140°F) and strength (if you drop it, it dents but doesn't shatter) makes beeswax a great wax to use when you're making container candles with children.

Gel wax: Feels like jelly

A newer product on the market, *gel wax* is basically mineral oil combined with resin to create a mixture that's the consistency of jelly. Gel wax is also called (surprise!) *jelly wax* and looks like a clear gel. You can find gel wax at most craft stores, usually in a round, bucketlike container.

If you've ever purchased a gel candle, you're aware that gel wax doesn't set hard. Because gel wax is clear, it's popular for embedding nonflammable objects, such as shells or decorative glass objects.

Vegetable-based wax: Straight from the earth

Believe it or not, waxes made from items such as soybeans, palm wax, and other vegetable bases are available. Fans of these waxes say they burn cleanly and are longer lasting than other chemical-based waxes, such as paraffin. But the main reason to opt for this type of wax is if you're a vegan.

REMEMBER

If the package doesn't specifically say that the wax is all vegetable, it probably isn't.

Finding the right wick

Any wick you choose should cause your candle to burn. But a well-chosen wick consumes all the melted wax at just the right pace, so that the wax doesn't drip off the candle and so that there's enough wax to keep the flame going.

Table 4-1 lists wick types and for which candles they're most appropriate.

TABLE 4-1 Types of Wicks and Their Uses

Type of Wick	Best Use
Flat braided	Tapers
Square braided	Beeswax candles, pillars, and other large candles
Metal cored	Any type of candle, but especially container candles, gel candles, votives, and tealights
Paper cored	Votives, tealights, and container candles (but don't use in gel candles)

After you decide on the type of wick, you need to figure out what size of wick you need. That decision depends mainly on your candle's diameter. If you're not sure what the diameter is, simply measure the width of your candle at its widest point. Table 4-2 gives you a general guide for choosing your wicks.

TABLE 4-2 Sizing Your Wick

Candle diameter	Suggested wick size
0–1 inch	Extra small, 20 ply
1–2 inches	Small, 24 ply
2–3 inches	Medium, 30 ply
3–4 inches	Large, 36 ply
4 inches or more	Extra-large, 40-plus ply

Rolling Beeswax Candles

This may just be the perfect first candle for beginners. You don't need to melt any wax or use a lot of fancy equipment. You simply roll sheets of beeswax into a round candle. No hot wax, no mess.

And if your homesteading efforts include beekeeping, your annual harvest doesn't have to begin and end with the honey; you can use your colony's own honeycombs!

Beeswax candles are desirable; unlike paraffin, they don't drip, don't sputter, and don't smoke, but they do burn a long time. Buy them in a gift store, and they're fantastically expensive. But not when you make them yourself!

The only downside is that beeswax is sticky at any temperature, and it gets even stickier when it's warm. But stickiness can work in your favor because the beeswax sheets adhere to each other as you roll them.

TIP

When you roll your candle, you want your beeswax sheet to be at room temperature. Ideally, it's been at this temperature for at least a few days.

To roll a beeswax candle, you need two sheets of beeswax and a primed wick. Here's what you want to do:

1. **Cut your primed wick so that it's ¾ inch longer than the height of your finished candle.**

   If you're using a normal beeswax sheet, which measures 8 inches x 16 inches, your candle will be about 8 inches tall, so you want your wick to be approximately 8¾ inches. If you want to make two 8-inch tapers instead, just cut the sheet in half long ways and roll two candles.

2. **Lay your beeswax sheet on a hard surface and place your wick along the edge, as shown in Figure 4-1.**

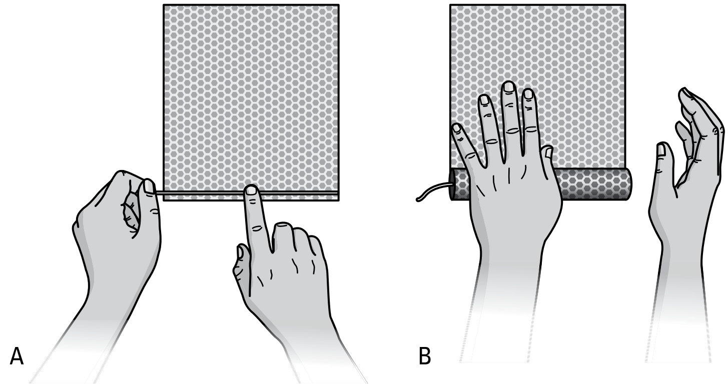


FIGURE 4-1: Making a beeswax candle is as simple as adding a wick and gently, but tightly, rolling it into a candle.

3. **Apply pressure, smoothly but firmly rolling the edge of the sheet around the wick and continue rolling the beeswax into a cylinder shape.**

   You want to make sure that you're rolling straight; otherwise, your edges won't align. You also want to roll tightly enough so that you don't trap air between the layers, which can affect how well your candle burns.

   TIP

   If you want to make a square candle, just flatten each side with a hard object as you roll. If you want to make a shorter candle, cut the short side of the beeswax sheet in half prior to rolling it.

4. **When you reach the end of the first sheet, attach your second sheet of beeswax by firmly pinching the edges of each sheet together and then continue rolling.**

   For a larger candle, you can use as many sheets of beeswax consecutively until you reach your desired diameter.

5. **Trim your wick.**

   Wait at least a day, preferably longer, before lighting.

REMEMBER

You want your beeswax to be at least room temperature or warmer, or it will break. If you're having trouble, try using a hairdryer to heat the sheets. But don't go too warm, or the wax may begin to melt and become a sticky mess.

Making Molded Candles

The type of candle you'll probably make the most is a basic molded candle. You can use this one basic technique to make many different types of candles. The type of mold you use doesn't matter; the steps are pretty much the same.

After you choose your mold, you need to figure out how much wax you need to melt. Pour water into your mold and measure the amount you used. For every 3.5 fluid ounces of water, you need 3 ounces of unmelted wax.

1. **Melt your wax to the package's specified temperature.**

   Place the wax in the top part of a double boiler. Bring the water in the bottom section to a rolling boil over medium heat until melted. Use a wax or candy thermometer to monitor the temperature.

   WARNING

   Don't use a microwave to melt your wax because the temperature is too hard to control, and you can easily overheat the wax.

   Unlike food, wax doesn't look done, and you can't test it with a fork. You need to constantly check your wax's temperature. As a rule, if you're registering temperatures in the 200°F range, you want to be careful. Most waxes combust if they're 400°F or more, and wax heats up quickly. Each wax's *flashpoint* — the temperature at which it combusts — is listed on its packaging.

2. **Spray your mold with a mold release, such as silicone or vegetable spray.**

   Using a releasing agent helps you remove the candle from the mold.

   TIP

   If you make candles regularly, you may want to use commercial grade release spray instead of vegetable oil because the vegetable oil can leave a film on your mold over time. However, if you make candles only on occasion, the vegetable oil spray works just fine.

3. **Cut your wick so that it's 2 inches longer than your finished candle's height and then insert it into your mold.**

4. **When your wax reaches the required temperature, add any additives, color, or scent.**

   Unless you're using a flexible mold, add stearin in proportion to 10 percent of your wax. Stearin has many benefits, but one in particular that is beneficial here is that it shrinks the wax, which makes your candle easier to remove from the mold.

   When you add ingredients, your wax's temperature will probably drop, so continue heating your wax a little longer until it reaches the proper temperature again.

5. **Remove your wax from the heat and slowly and smoothly pour it into your mold.**

   Be careful not to get any water into your wax. Remember that the container is hot, so you want to use potholders and get a firm grip on the container's handle. Pour your wax into the mold until it's almost full. Stop about ½ inch before you reach the top of the mold. Pouring smoothly is key. Don't constantly change directions; you can wiggle the mold later to get it to set perfectly.

6. **Wait a few minutes and then gently tap the side of your mold to remove any air bubbles.**
7. **As your wax cools, poke holes in the wax around the wick to release tension.**

   If you don’t, the wax pulls the wick off center and may create a concave section on the outside of the candle.
8. **After your wax has cooled quite a while, reheat the extra wax you saved and pour it into any holes that have occurred as the wax cools.**

   This step is called a *repour.*
9. **Let your wax cool almost completely and then do a second repour.**

   WARNING

   Don’t rush this step. If you repour the wax while the candle is still hot and liquid, you’re just adding more hot wax that has to shrink.

   After your candle has completely cooled, you’re ready to remove it from the mold. You simply remove any mold sealer that you used, which should release the candle.

REMEMBER

When you remove your candle from the mold, remember that the bottom of the mold now becomes the top of the candle.

If your candle isn’t coming out of your mold, you may not have let it cool long enough. Wait a few hours and try again later.

After some practice, you’ll almost certainly want to add color or scent or both to your candles. You can add solid wax dye disks or liquid dyes to your wax during the melting process. To make a scented candle, use fragrances designed for candles and add it to the wax at the last possible moment before pouring. You can try essential oils, but they rarely work well in candles.

Taking a Dip with Tapers

Dipping candles is a fairly easy process. You basically melt the wax, dip both ends of a wick in it, let it cool, and repeat 20 to 30 times or more until your candle is the desired width. (Most tapers are usually ½ inch in diameter, but don’t feel like you need to follow the crowd. Just remember that if you make the candle too thick, you’re creating a funny-looking pillar instead of a slim taper!) Fortunately, you don’t have to do anything special to create the tapered look; it just naturally happens.

Here's how the process works:

1. **Figure out how tall you want each taper, add a couple of extra inches so that your wick protrudes, double that amount, and then add 4 inches for space.**

   When you make tapers, you usually dip in pairs, but you use only one wick. If you want to create a 6-inch taper, for example, then you take 6 inches plus 2 inches to get 8 inches. You multiply that number by 2 to get 16 inches (enough wick for two candles) and then add 4 inches to the total so that you have space in between the candle. (You don't want the ends of your wick to touch each other when you dip.) So to make two 6-inch tapers, you need to cut your wick to 20 inches.

2. **Tie a weight to each end of the wick so that it stays submerged and straight while you dip.**

   Rocks work just fine as weights. You remove these weights later when the wick is strong enough to stay straight.

TIP

3. **Melt your wax.**

   When you dip candles, you usually use paraffin wax or a mixture of beeswax and paraffin. Either way, you probably need to add the usual 10 percent stearin. Melt twice the wax you think you need. You need to have plenty left over so that you have enough wax to dip in.

   Dipping works best when your wax is approximately 160°F to 170°F.

4. **Fill your dipping can with wax.**

   You need to make sure that your dipping can is tall enough to accommodate the size of the candle you want to make. Also fill the dipping can fairly full so that you can dip almost all the way up the wick. You have to keep adding wax to the dipping can throughout the process to keep it full.

5. **Dip your wick into your melted wax, allow it to cool, and then re-dip your wick repeatedly until you reach your desired diameter, as shown in Figure 4-2.**

   You want to dip your wick deep enough so that you have only a few inches of undipped wick remaining. Don't linger too long on this dip, though. You want your wick in the wax only for a second. Plunge it in and then remove it smoothly so that the wax doesn't blob.

   - If your taper looks bumpy, your wax isn't warm enough.
   - If your wax isn't building up on your wick, your wax is too hot.
   - If the wax isn't firming up enough between dips, you need to let it cool longer in between dips.

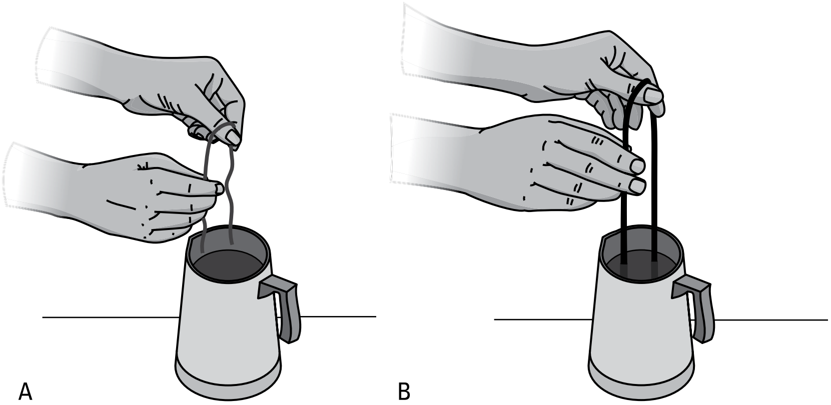


FIGURE 4-2: Dipping a taper.

WARNING

Make sure that the ends of your wick don't touch each other, or you'll end up with a wax glob. You can use your hands to keep the ends apart, or you may want to use a straw, dowel rod, or piece of cardboard.

6. **Place your wicks over a rack or dowel rod until they cool.**

   The cooling process takes approximately 3 minutes. Basically, the wax should feel cool to your touch.

7. **Repeat Steps 5 and 6 until your candle is the diameter you want.**

   You may have to dip your candles 20 or 30 times or even more. Every time you dip, more wax builds up on your wick. Eventually, your wick becomes two tapers.

TIP

   If you want your surface to be glossy, then dip it immediately into cool water after your last dip.

8. **Let your tapers cool a few hours before handling them and trimming your wick to ¼ inch.**

In general, taper candles are 7⁄8 inch in diameter at the bottom so that they can fit into most candleholders. If you're not using a mold, you probably need to cut the base of the candle down to that size.

Of course, if you already know which candle holders you'll be using, you can cut your candle's base down to that particular holder's size. To do so, use a craft knife to score around the base of your cooled candle. Then simply remove the strips of wax until your taper fits perfectly into the holder.

Cleaning Up with Homemade Soap

The technique you use to make your own soaps determines the amount of time you invest in your hobby. This book covers two basic soapmaking techniques: hand milling and melting and pouring. (You can also make soap from scratch by using lye, but the process is more complex and requires care in handling sodium hydroxide, which is a caustic substance. So we don't cover it here.)

Making hand-milled soap

If you don't like the idea of working with chemicals, you may want to try making hand-milled soap. All you do is take an existing bar of commercial soap, grate it, and then remelt it with water. You can then color, scent, and mold it as you please.

Many diehard soapmakers scoff at this technique. They say that you're technically not making the soap because you're using commercial soap, which *may* be soap but more than likely is a synthetic detergent bar. (If you have a preference for "real" soap, be sure to read the label and buy soap that has ingredients such as sodium cocoate, sodium palmate, sodium olivate, and so on.) But if you want to exercise a little creativity, you can still do so when you hand-mill soap. You can craft soap that looks and smells the way you want it to- something you can't always find at the store.

TIP

If you plan to scent your soap, make sure that you start with an unscented bar of commercial soap.

If you think you want to make soap, why not try hand-milling soap that you already have? The only special tool that you really need is a hand grater.

Here are the basic steps.

1. **Grate your soap, as shown in Figure 4-3.**

   The smaller you grate your pieces, the quicker the melting time.

2. **Melt your pieces in water in the top pot of a double boiler or in a microwave.**

   Use approximately 1 cup of water for every 2 cups of soap gratings. If using the microwave, heat the shavings and water in short bursts and check often, stirring as needed. Some people set their microwaves at 50 percent power when melting clear glycerin soap base or shavings. Experiment with what works best for you and your microwave.

3. **Stir your soap as it melts.**

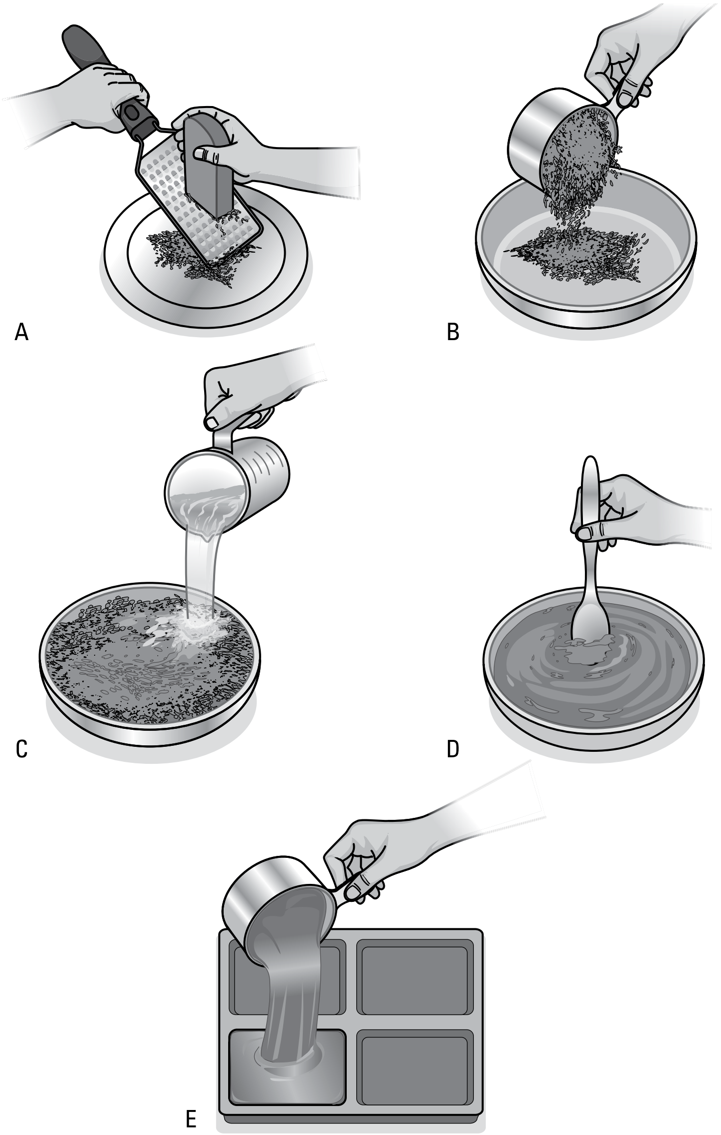


FIGURE 4-3: Hand-milling soap.

4. **After the soap has melted, stir in your color.**
5. **Continue stirring until the soap is thick and creamy and then remove it from the heat.**
6. **Add any other additives, such as essential oils.**
7. **Pour your soap into the mold.**
8. **Let the soap cool overnight before removing it from the mold.**

REMEMBER

Your soap isn't finished just because it's out of the mold. Allow it to solidify for three to seven days.

Making melt-and-pour soap

If making hand-milled soap sounds like cheating to you, then making melt-and-pour soap may be right up your alley. Instead of using commercial soap, you use a melt-and-pour soap base that you purchase in a craft store. The base comes in blocks, chunks, or nuggets, and you simply melt the amount you need and then mold it.

Probably more than any other soapmaking technique, melt-and-pour soapmaking resembles the steps involved in making candles. Like candlemaking, you use premade material, melt it, and mold it. If you love to make candles, chances are you'll enjoy making melt-and-pour soaps.

Here's how melt-and-pour soapmaking works:

1. **Melt your soap chunks in a double boiler over medium heat or melt them in a heat-resistant bowl in the microwave (see Figure 4-4).**

   You can also cut 1- or 2-inch chunks off a large 1-pound or 5-pound block of soap if you're not using precut chunks.

   If you're melting your soap in the microwave, melt your soap at 50 percent heat for approximately 1 minute. Stir your soap. Continue melting it at 20-second intervals until the soap is completely melted.
2. **Remove your melted soap from the heat and stir in any additives, such as color.**
3. **Pour your melted soap into the mold.**

   Most melt-and-pour soaps shrink as they set, so you probably don't need to spray your mold with a releasing agent.
4. **Allow your soap to cool for approximately 1 hour.**

Although melt-and-pour soap is immediately safe for the skin, let it dry out and harden for a few days before use, so that it will last longer.

Enhancing your soap with additives

Additives are generally anything you add to your soap base to enhance its color, scent, texture, skin-care benefits, or overall aesthetic value.

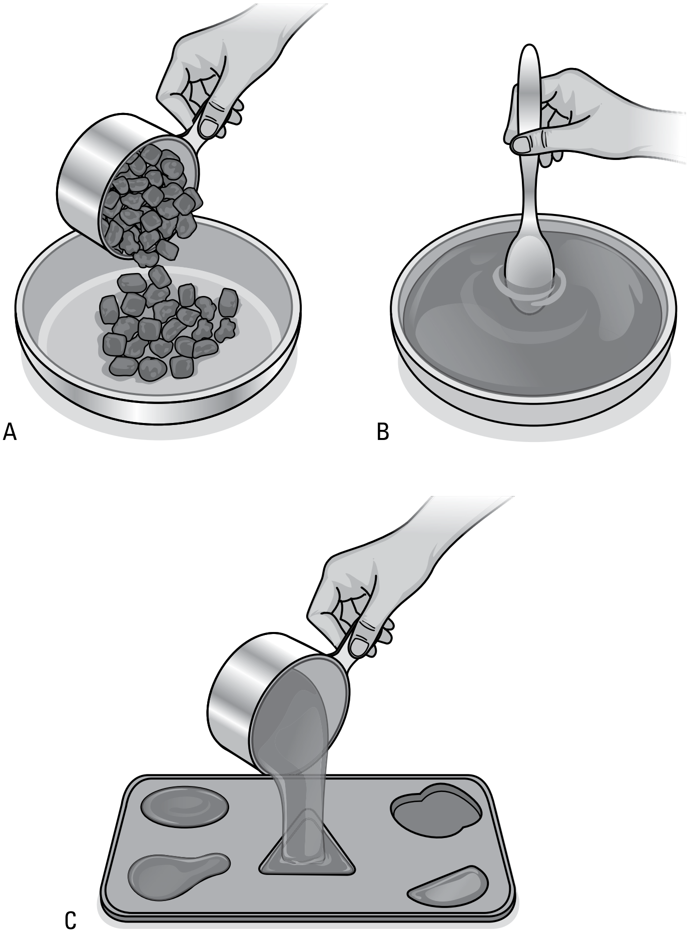


FIGURE 4-4: You can use a microwave to melt your soap chunks. Then you just need to pour your melted soap into a mold.

You stir in the additives as the last step before pouring your soap into the mold and after the soap has been melted.

TIP

If you're adding a solid additive to melt-and-pour soap, be aware that it may *separate,* or sink to the bottom of your mold. To avoid this problem, let your soap cool more than you usually would, stirring the additive into the soap the entire time. You want the soap mixture to thicken in your bowl before you pour it into the mold, much like thickening gelatin. Waiting longer than usual can help the solid additive stay suspended in the soap.

Table 4-3 describes popular additives.

You can add color to your soap by using a melt-and-pour soap base or soap dyes. To add a scent, use your favorite essential oils, manufactured fragrance oils, or even spices and extracts from the kitchen or herbs straight from the garden!

TABLE 4-3

Common Soapmaking Additives

Additive	Description
Almond oil	Soothes irritated, itchy skin. Also used as base. Has slight odor.
Aloe vera	Relieves dry and burned skin. Can use in plant or gel form.
Apricot	Softens skin. A popular bath additive. To use, place dried apricots in water for several hours and then liquefy.
Apricot kernel oil	Softens skin. Especially good for sensitive skin.
Beeswax	Hardens soap and contributes scent. Need to melt before adding to soap. Don't use more than 1 ounce per pound of soap.
Clay	Helps dry out oily skin. Choose finely powdered French clay.
Cocoa butter	Hardens soap and moisturizes. Looks and smells like white chocolate, but can be purchased in a deodorized form if you want its qualities without the chocolate smell.
Cucumber	Acts as astringent. Use grated skin or liquefied.
Glycerin	Moisturizes skin.
Herbs	Contribute texture and color.
Honey	Moisturizes skin and makes soap softer.
Lanolin	Hardens soap. Moisturizes and softens skin. Can cloud soap. Don't use if allergic to wool.
Lemon	Adds texture and speckling, as well as antibacterial qualities. Use grated peel.
Oatmeal	Softens and exfoliates skin. Adds texture. Use ground rolled oats. Limit to a maximum of ½ cup rolled or ¼ cup ground or pulverized oats per pound of soap. A blender works well for making oat flour.
Pumice	Removes tough dirt, but can be harsh. Adds texture.
Vitamin E oil	Use as a preservative when you add fresh fruit or other additive at risk of spoiling.
Wheat germ	Exfoliates skin, as well as adding bulk and texture. Shows up in soap as light speckling. Use no more than 3 tablespoons per pound of soap.

4

Raising Animals

Contents at a Glance

CHAPTER 1: **Introducing Beekeeping** 457
Breaking into Backyard Beekeeping 458
Choosing the Right Hive 461
Gearing Up for Beekeeping 467

CHAPTER 2: **Caring for Your Bee Colony** 473
Busying Yourself with Bee Activity 474
Holding Out for Honey 481
Harvesting Your Honey 485
Swarming and Absconding 496
Playing Doctor: Fighting Disease 498
Battling Varroa Mites 502
Colony Collapse Disorder 506

CHAPTER 3: **Introducing Backyard Chickens** 509
Thinking Through Chickenkeeping 510
Chicken Breeds 516
Analyzing the Anatomy of a Coop 525

CHAPTER 4: **Raising Your Chicken Flock** 529
Feeding Your Flock 529
Raising Baby Chicks 536
Pests and Predators 544
Expecting Eggs (for Eating) 549

CHAPTER 5: **Opting for Other Animals** 553
Raising Rabbits 554
Getting Your Goats 555
Figuring Out Fowl: Ducks, Geese, and Turkeys 556
Goin' Fishin' 558

IN THIS CHAPTER

- **Deciding whether beekeeping is right for you**
- **Investigating four different hive types**
- **Gathering the gear you'll need**

Chapter 1

Introducing Beekeeping

For many homesteaders just starting out, incorporating a colony of bees into their backyard is a box they're eager to check. And although the first motivator might be honey, that sweet reward is by no means the only reason folks are attracted to beekeeping. Since the 18th century, agriculture has recognized the value of pollination by bees. Without the bees' help, many commercial crops would suffer serious consequences. More on that later.

Even backyard beekeepers witness dramatic improvements in their garden: more and larger fruits, flowers, and vegetables. A hive or two in the garden makes a big difference in your success as a gardener and a homesteader.

This chapter helps you understand a bit more about beekeeping and the commitment involved, to help you decide whether bees would "bee" (just once — had to) a worthy addition to your homestead. From there, you can take a closer look at the different types of hives for housing your colony, and the pros and cons of each. Finally, you'll need some specialized stuff for your new beekeeping endeavor; the last section gets you geared up properly.

If you're looking for more hands-on info on caring for your colony throughout the year, troubleshooting potential problems, and harvesting honey, skip ahead to Chapter 2 of this minibook.

Breaking into Backyard Beekeeping

How do you know whether you'd make a good beekeeper? Is beekeeping the right hobby for you? Here are a few things worth considering as you ponder these issues.

Environmental considerations

Bees are remarkable creatures that do just fine in a wide range of climates. Beekeepers can be found in areas with long, cold winters; in tropical rain forests; and in nearly every geographic region in between. If flowers bloom in your part of the world, you can keep bees.

How about space requirements? You don't need much. There are even beekeepers in the heart of Manhattan! They have a hive or two on their rooftops or terraces. Keep in mind that bees travel one to two miles from the hive to gather pollen and nectar. They'll forage an area as large as 6,000 acres, doing their thing. So the only space that you need is enough to accommodate the hive itself.

Honey bees are amazingly adaptable, but you'll get optimum results and a more rewarding honey harvest if you follow some basic guidelines (see Figure 1-1). Basically, you're looking for easy access (so you can tend to your hives), good drainage (so the bees don't get wet), a nearby water source for the bees, dappled sunlight, and minimal wind. Keep in mind that fulfilling all these criteria may not be possible.

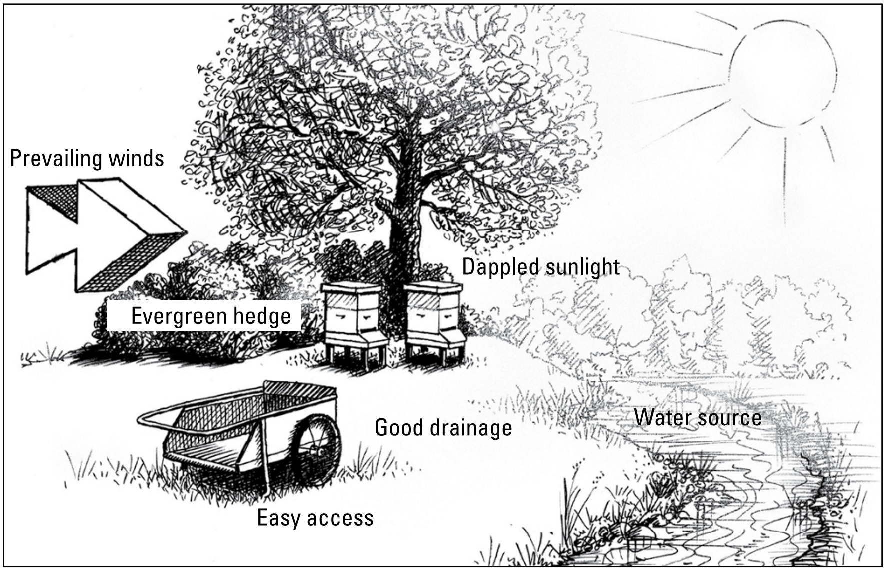


FIGURE 1-1: The picture-perfect bee yard. Not always possible, but an admirable objective.

Courtesy of Howland Blackiston

Do the best you can by

- Facing your hive to the southeast. That way your bees get an early morning wake-up call and start foraging early.
- Positioning your hive so it is easily accessible come honey harvest time. You don't want to be hauling hundreds of pounds of honey up a hill on a hot August day.
- Providing a windbreak at the rear of the hive.
- Putting the hive in dappled sunlight. Ideally, avoid full sun or deep, dark shade.
- Making sure the hive has good ventilation. Avoid placing it in a gully where the air is still and damp. Also, avoid putting it at the peak of a hill, should you live in a region where the bees will be subjected to winter's fury.
- Placing the hive absolutely level from side to side, and with the front of the hive just slightly lower than the rear (a difference of an inch or less is fine) so rainwater drains out of the hive (and not into it).

  TIP Mulching around the hive prevents grass and weeds from blocking its entrances.
- Locating your hive on firm, dry land.

Zoning and legal restrictions

Most communities are quite tolerant of beekeepers, but some have local ordinances that prohibit beekeeping or restrict the number of hives you can have. Some communities let you keep bees but ask that you register your hives with the local government. Check with local bee clubs, your town hall, your local zoning board, or your state's Department of Agriculture (bee/pollinating insects division) to find out about what's okay in your neighborhood. You want to practice a good-neighbor policy so that folks in your community don't feel threatened by your new hobby.

Costs and equipment

What does it cost to become a beekeeper? All in all, beekeeping isn't a very expensive hobby. You can figure on investing about $300 to $400 for a start-up hive kit, equipment, and tools — less if you build your own hive from scratch. You'll spend around $100 or more for a package of bees and queen. For the most part, these are one-time expenses. Keep in mind, however, the potential for a return on this investment. Your hive can give you 60 to 90 pounds of honey every year. At around $8 per pound (a fair going price for all-natural, raw honey), that should give you an income of $480 to $720 per hive!

How many hives do you need?

Most beekeepers start out with one hive, which is probably a good way to start your first season. But in short order, most beekeepers wind up getting a second hive. Why? For one, it's twice as much fun! Another more practical reason for having a second hive is that recognizing normal and abnormal situations is easier when you have two colonies to compare. In addition, a second hive enables you to borrow frames from a stronger, larger colony to supplement one that needs a little help. You may choose to start with one hive until you get the hang of things and then consider expanding in your second season.

What kind of honey bees should you raise?

The honey bee most frequently raised by beekeepers in the United States today is European in origin and has the scientific name *Apis mellifera.*

Of this species, the most popular variety is the so-called Italian honey bee. These bees are docile, hearty, and good honey producers. They are a good choice for the new beekeeper. Both Carniolans and Russians are also gentle, productive, and do well in many different climates. Italians, Carniolans, Russians: all are great bees for beginning beekeepers. Look no further than these three in your first year.

Time and commitment

Beekeeping isn't labor intensive. Sure, you'll spend part of a weekend putting together your new equipment. And there should be time spent reading up on your new hobby. But the time that you absolutely *must* spend with your bees is surprisingly modest. Other than your first year (when you should inspect the hive frequently to find out more about your bees), you need to make only five to eight visits to your hives every year. Add to that the time you spend harvesting honey, repairing equipment, and putting things away for the season, and you'll probably devote 35 to 40 hours a year to your hobby (more if you make a business out of it).

Stings and allergies

If you're going to become a beekeeper, you can expect to get stung once in a while. It's a fact of life. But when you adopt good habits as a beekeeper, you can minimize or even eliminate the chances that you'll be stung.

All bee stings can hurt a little, but not for long. It's natural to experience some swelling, itching, and redness. These are *normal* (not allergic) reactions. Some folks are mildly allergic to bee stings, and the swelling and discomfort may be more severe. And yet, the most severe and life-threatening reactions to bee stings occur in less than 1 percent of the population. So the chances that you're dangerously allergic to honey bee venom are remote. If you're uncertain, check with an allergist, who can determine whether you're among the relatively few who should steer clear altogether of beekeeping.

TIP

Some beekeepers actually look forward to getting stung a few times early each season. They claim that occasional stings produce a kind of tolerance to the swelling and itching that follow, until the side effects of being stung disappear entirely for some. (The sting itself still smarts, though.) However, medical research shows that true allergic reactions worsen with each sting suffered over time. The takeaway? Having an EpiPen on hand isn't a bad idea, just in case you or someone else does experience a severe reaction.

Dealing with nervous neighbors

Bees living near people can cause anxiety, especially in the close quarters of city living or in a suburban environment. Education is, of course, one of the best remedies for making neighbors more comfortable. And so is a tasty bribe. Give a jar of honey to your neighbors to sweeten their view of bees and beekeeping. Promise them that there's more where that came from!

TIP

If your hive has not yet produced honey, don't wait until it does. Just buy someone else's honey and present it to nervous neighbors as a preview of the sweet treat that awaits them in the future.

With the gift jar, include a thoughtfully worded letter that explains what you are planning to do. Let them know it's perfectly legal (assuming it *is* legal in your area). Explain the wonder of honey bees. Exude the virtues of pollination. Share the magic of how local honey fends off pollen allergies. Reassure them that bees rarely sting unless threatened. Give your neighbors time to get past the fear factor; let them digest what they've read and appreciate what they've tasted.

Choosing the Right Hive

Beehives come in many different styles, sizes, and shapes. This section helps you understand the differences among the most popular hives for homesteading purposes and allows you to select a hive style that best meets your needs and objectives. Each has some benefits and drawbacks, but any one of these is functional and fun for your adventure in beekeeping.

Langstroth hive

Hands down, the *Langstroth hive* is the most popular and widely used hive today. Invented in 1852 by Reverend Lorenzo Langstroth, the basic design has remained mostly unchanged, which is a testament to its practicality. See Figure 1-2.

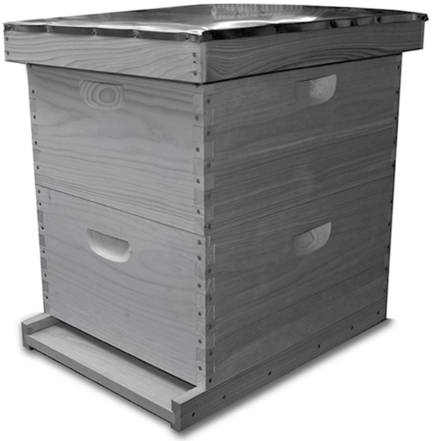


FIGURE 1-2: This is a ten-frame Langstroth hive, showing a bottom board, two deep-hive bodies, and a cover.

Courtesy of Howland Blackiston

The big advantage of this hive is that the bees build honeycomb into frames, which can be removed, inspected, and moved about with ease. Some other advantages to consider regarding the Langstroth hive include the following:

- **Capacity:** Because this design consists of modular, interchangeable hive parts, you can add extra medium or shallow honey supers as the colony grows and honey production increases. Capacity for bees and honey is virtually unlimited.
- **Frames:** There are both eight- and ten-frame versions of the Langstroth hive available (the eight-frame version being a slightly smaller and lighter hive in weight than its ten-frame cousin). Both versions use a Langstroth-style of self-centering frame with beeswax foundation inserts.
- **Universality:** Because the Langstroth hive is so widely used around the world, you can easily find replacement parts, gadgets, and add-ons for this popular hive. They are widely available from many beekeeping supply stores (search the web and you will find many such suppliers).

Kenyan top bar hive

In recent years, interest has increased in the *Kenyan top bar hive,* with its elegantly simple, practical design, particularly because more and more backyard beekeepers are seeking natural and environmentally sustainable options. Top bar hives are used extensively throughout Africa and in other developing countries where building materials are scarce. This particular design (shown in Figure 1-3) is referred to as a Kenyan top bar hive because of its sloped sides, which tend to result in stronger, more balanced combs. In addition, the sloped sides discourage the bees from attaching the comb to the bottom and sides of the hive.

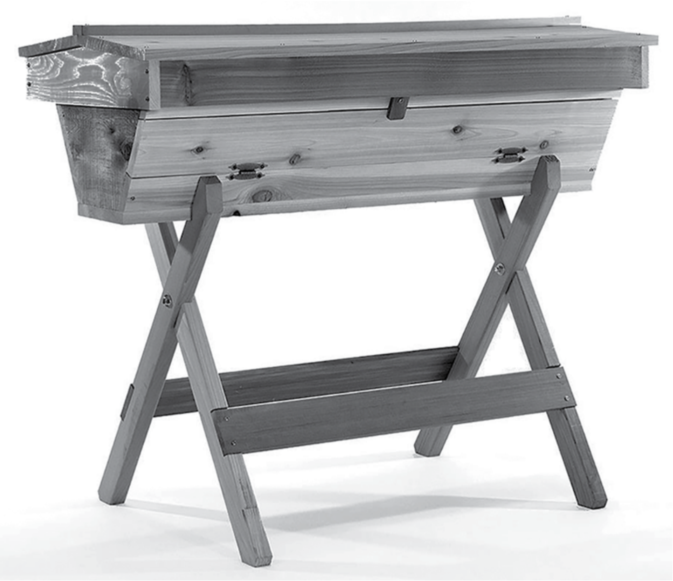


FIGURE 1-3: The Kenyan top bar hive is likely one of the oldest beehive designs, going back centuries.

Courtesy of Bee Thinking

A Kenyan top bar hive has many design variations. Basically they all consist of a long, horizontal hive body with sloped sides, top bars (not frames), and a roof. It's a practical and functional hive.

Here are some of the basics to consider:

- **Capacity:** You can't add supers or additional hive bodies. The space is fixed and thus limited to the size of the hive and the top bars it accommodates.
- **Frames:** There are no frames. This design uses top bars. There are no side bars, no bottom bar, and no full sheets of beeswax foundation to deal with (nor the costs associated with these elements). The bees attach their comb

naturally onto each of the top bars placed in the hive. The top bar hive can be made any length, but it's typically between 3 and 4 feet long, containing approximately 28 top bars in all.

- **Universality:** The dimensions for top bar hives are not standardized, and thus the gadgets and add-ons that are easy to find for Langstroth hives (for example, feeders, screened bottom boards, honey-extracting equipment) are usually not commercially available for top bar hives. Often beekeeper must custom build their own accessories.

  REMEMBER

  If you plan to also have Langstroth hives, none of the equipment is interchangeable between top bar and Langstroth hives.

However, there are also some cons:

- There tends to be lower honey production from this type of hive.
- Combs are much more fragile than comb built in a Langstroth-style frame (with the support of side bars and a bottom rail). Care needs to be taken when removing and handling combs of a top bar hive.
- Some feel this horizontal design may not be the best option for those keeping bees in areas with long and harsh winters.
- This hive has the largest footprint of the hives mentioned in this chapter. That may be an issue for beekeepers with limited real estate to work with (such as urban beekeepers).

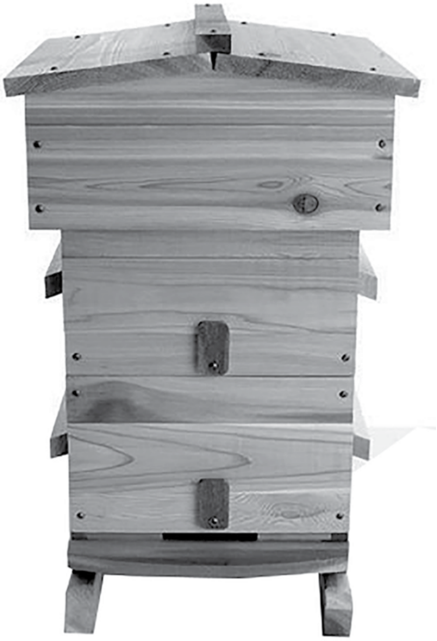
Warré (people's) hive

The *Warré hive* (shown in Figure 1-4) was developed in France during the early 20th century by Abbé Émile Warré, an ordained priest and an avid beekeeper. His vision was to develop an easy-to-build and easy-to-manage beehive with which everyone could have success (thus, it is often referred to as *the people's hive*). This simple, cost-effective, and efficient design has been gaining renewed popularity among DIY beekeepers.

Here are some of the reasons that the Warré hive has gained such popularity among hobbyists:

- **Capacity:** The tall, vertical design provides ample room for the colony to naturally grow throughout the season. The beekeeper does not need to anticipate the colony's growth and add hive bodies during the season. All the space that's needed is provided from the get-go.

FIGURE 1-4: The Warré hive is a top bar hive without foundation that allows the bees to build comb as they would in nature.



Courtesy of Bee Thinking

- **Frames:** This design does not use frames or foundation. It uses top bars, upon which the bees draw out their own natural comb. There are no side bars, no bottom bar, and no full sheets of beeswax foundation to deal with (nor the costs associated with these elements). The bees build their comb without restriction onto each of the top bars placed in the hive (see Figure 1-5).
- **Universality:** All the gadgets and add-ons that you might use with a conventional Langstroth hive (feeders, queen excluders, foundation, and honey-extracting equipment) are irrelevant to the Warré. Its design is virtually all-inclusive and requires no extras. However, if you need a new roof, there are an increasing number of beekeeping supply stores offering pre-built Warré components.

The Warré hive provides more natural conditions to the bees, offering a living arrangement that is similar to how bees live in the wild (within the hollow of a tree). As a result, the bees tend to be less stressed and thus less prone to disease.

On the downside, harvesting of honey requires destroying the comb, since it must be crushed to extract the honey. And due to the hive's construction, making artificial swarms, splits, reversals, and other manipulations, such as feeding sugar syrup or administering medications, are difficult or even impossible. But the whole idea of this design is to provide as natural an environment as possible for your bees. Frequent manipulations are contrary to the all-natural objective.

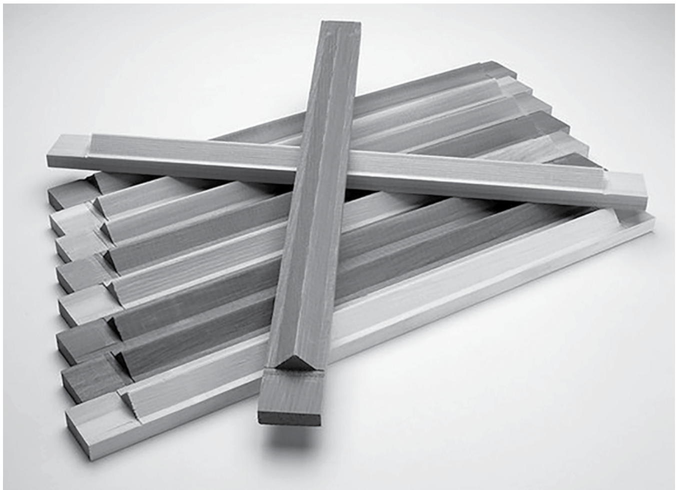


FIGURE 1-5: The Warré hive is a top bar hive without foundation that enables bees to build comb as they would in nature.

Courtesy of Bee Thinking

Five-frame nuc hive

The design of the *five-frame nuc (nucleus) hive* is similar to the Langstroth hive, only in miniature (see Figure 1-6). Although the nuc hive may not be your only hive in the yard, it's mighty handy to have one or two of these "mini-me" hives nearby: as a nursery for raising new queens, to house a captured swarm, as a supplementary source of brood, pollen, and nectar, or just to help with pollination.

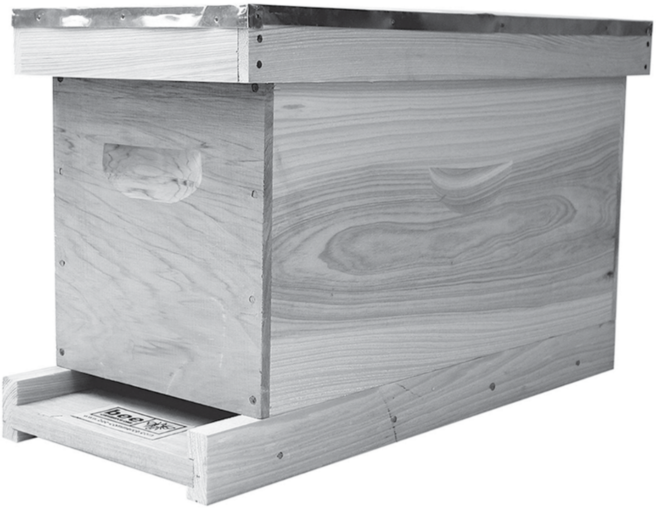


FIGURE 1-6: A nuc hive is a small hive with a few frames of bees.

Courtesy of Bee-Commerce

They say that good things come in small packages. See what you think as you review the basic statistics for the five-frame nuc:

- **Capacity:** Because this design consists of only five frames, there is no room for expansion as the colony grows in population, so the capacity for bees is limited. Theoretically, you could build additional nuc hive bodies and stack them one on top of the other to allow the colony to grow. That's not really the purpose of a nuc hive, though.
- **Frames:** This nuc hive uses a Langstroth-style of self-centering deep frame with deep beeswax foundation inserts. A total of five frames are used with the nuc hive.
- **Universality:** Because the nuc uses Langstroth-style frames, you can easily purchase the right size foundation for this hive. Virtually all suppliers sell nuc hives and their associated parts.

A disadvantage of a nuc hive is that it doesn't overwinter well in colder climate zones. It *can* be done, but it takes effort and talent on the part of the beekeeper. Another disadvantage is that these small hives are more fragile and difficult to manage than larger hives. They get overcrowded and swarm frequently, and the population is too small to deal with environmental ups and downs.

Gearing Up for Beekeeping

Beekeepers use all kinds of fantastic tools, gadgets, and equipment. Quite frankly, part of the fun of beekeeping is putting your hive together and using the paraphernalia that goes with it.

Bee-proof clothing

At minimum, new beekeepers should wear a long-sleeved shirt when visiting the hive. Light colors are best — bees don't like dark colors (black, navy, and so on). Wear long pants and slip-on boots. Tuck your pant legs into the boots. Alternatively, use Velcro or elastic strips (even rubber bands) to secure your pant legs closed. You don't want a curious bee exploring up your leg! Better yet, order a bee suit (coveralls) or a bee jacket from your beekeeping supplier. You should also invest in veils and gloves, which are discussed in this section.

Veils

Don't ever visit your hive without wearing a veil. Although your new colony of bees is likely to be super gentle (especially during the first few weeks of the season), it defies common sense to put yourself at risk around upwards of 60,000 bees.

Veils come in many different models (see Figure 1-7) and price ranges. Some are simple veils that slip over your head; others are integral to a pullover jacket or even a full coverall. Choose the style that appeals most to you. If your colony tends to be more aggressive, more protection is advised. But remember, the more that you wear, the hotter you'll be during summer inspections.

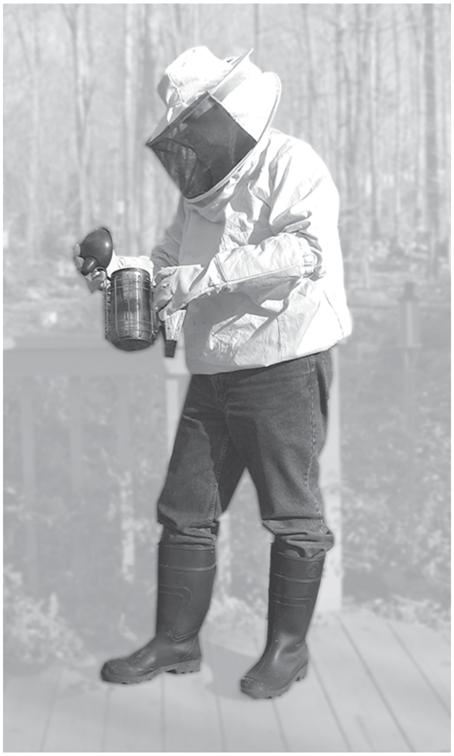


FIGURE 1-7: This beekeeper uses a veil-and-jacket combination, leather gloves, and high boots to keep him bee-tight.

Courtesy of Howland Blackiston

TIP

Keep an extra veil or two on hand for visitors who want to watch while you inspect your bees.

Gloves

New beekeepers understandably like the idea of using gloves (see Figure 1-8), but it's best not to use them for installing your bees or for routine inspections.

You don't need them at those times, especially with a new colony or early in the season. Gloves only make you clumsier. They inhibit your sense of touch, which can result in your inadvertently injuring bees. That's counterproductive and only makes them more defensive when they see you coming.

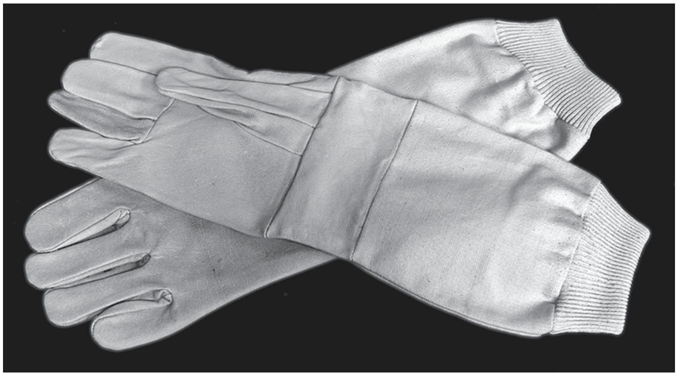


FIGURE 1-8: Although not needed for routine inspections, it's a good idea to have a pair of protective gloves.

Courtesy of Howland Blackiston

The only times that you really need to use gloves are

- Late in the season (when your colony is at its strongest)
- During honey harvest season (when your bees are protective of their honey)
- When moving hive bodies (when you have a great deal of heavy work to do in a short period of time)

Other times leave the gloves at home. If you must, you can use heavy gardening gloves, or special beekeeping gloves with long sleeves (available from beekeeping supply vendors).

Fundamental tools

Two tools — the smoker and the hive tool — are musts for the beekeeper. They're used every time you visit any kind of hive and are indispensable.

Smoker

The smoker will become your best friend. Smoke changes the bees' behavior and enables you to safely inspect your hive. Quite simply, the smoker is a fire chamber with bellows designed to produce lots of cool smoke. Figure out how to light it so it stays lit, and never overdo the smoking process. A little smoke goes a long way.

TIP

To watch an online video on how to light and properly use a smoker, just go to `www.dummies.com/go/beekeepingfd4e`.

Smokers come in all shapes, sizes, and price ranges. Two models are shown in Figure 1-9. The style that you choose doesn't really matter. The key to a good smoker is the quality of the bellows. Consider one fabricated from stainless steel to avoid rusting.

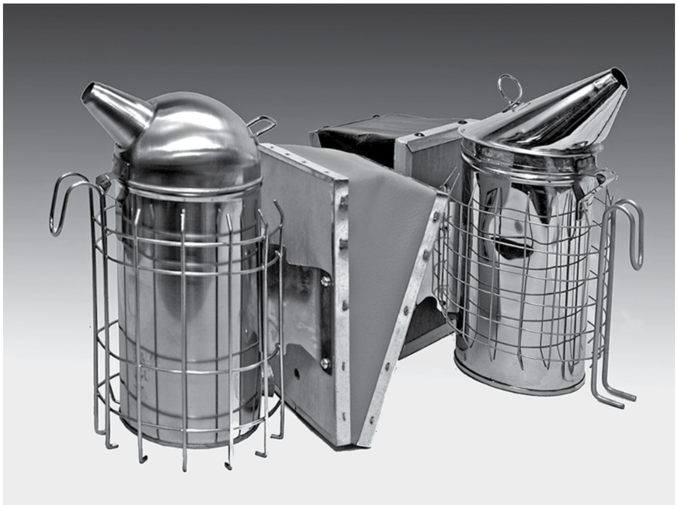


FIGURE 1-9: Two styles of smokers.

Courtesy of Howland Blackiston

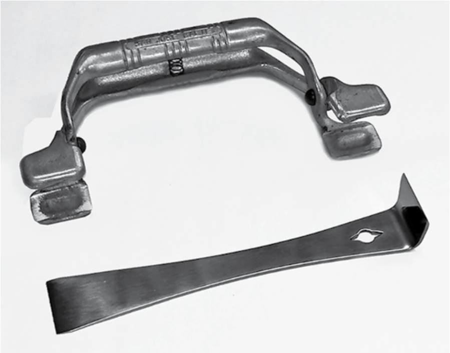
Hive tool and frame lifter

The versatility of the simple hive tool is impressive. Don't visit your hives without one! Use it to scrape wax and *propolis* (a sticky, resinous material that bees collect from trees and plants and use to seal up cracks and strengthen comb; think "bee glue") off woodenware. Use it to loosen hive parts, open the hive, and manipulate frames. In addition, a frame lifter is used by many beekeepers to firmly grip a frame and remove the frame from the hive. Bee suppliers offer a wide range of styles and designs to choose from. The ones pictured in Figure 1-10 are among the most commonly used.

Elevated hive stand

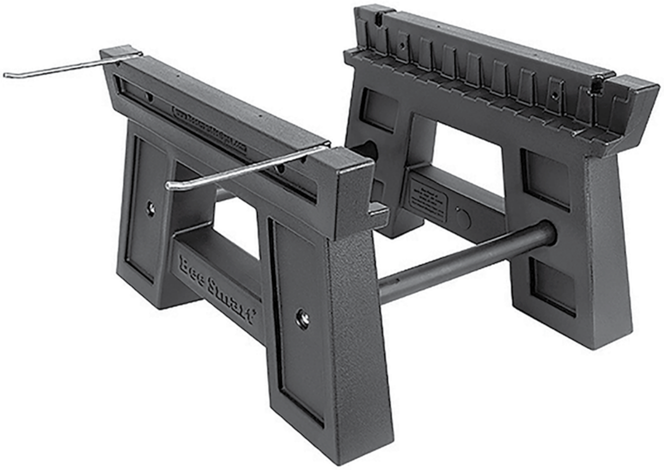
Elevated hive stands are something you're more likely to build than purchase. Alternatively, you can fashion an elevated stand from a few cinderblocks or a simple post, or you can purchase a commercial-grade stand that's waterproof and comes with a built-in frame rest (see Figure 1-11). In any case, having the hive off the ground means less bending over during inspections and makes the hive far easier to work with.

FIGURE 1-10: A frame lifter (top) and a hive tool (bottom).



Courtesy of Howland Blackiston

FIGURE 1-11: This commercially available hive stand is weatherproof and includes a built-in frame rest.



Courtesy of Beesmart.com

TIP

To help prevent ants from invading your hive and nesting under your top cover, the legs of the stand can rest in a container of liquid large enough to act as a moat. This will prevent ants from crawling up the legs. Raising the entrance using an elevated hive stand also is a natural way to deter skunks from snacking on your bees.

Frame rest

For users of a Langstroth hive, a frame rest is a super-helpful device. This gadget hangs on the side of the hive, providing a convenient and secure place to rest frames during routine inspections (see Figure 1-12). It holds up to three frames, giving you plenty of room in the hive to manipulate other frames without crushing bees.

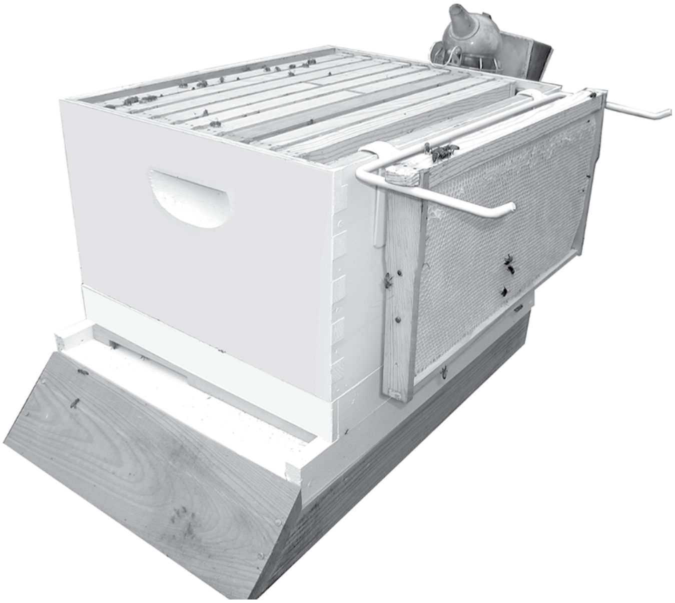


FIGURE 1-12: A frame rest is a handy device for holding frames during inspections.

Courtesy of Howland Blackiston

Bee brush

The long, super-soft bristles of a bee brush enable you to remove bees from frames and clothing without hurting them (see Figure 1-13). Some beekeepers use a goose feather for this purpose. Keep that in mind in the event you have an extra goose around the house.

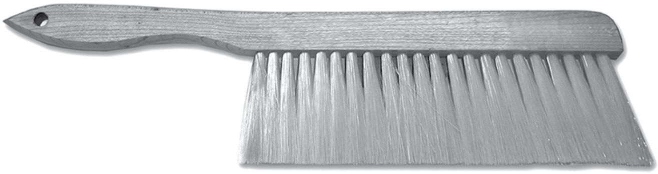


FIGURE 1-13: Use a soft bee brush to gently remove bees from frames and clothing.

Courtesy of Howland Blackiston

IN THIS CHAPTER

- Keeping busy with colony care throughout the year
- Harvesting honey
- Watching out for problems and diseases

Chapter 2

Caring for Your Bee Colony

Although beekeeping doesn't require a huge time commitment for the backyard homesteader, some regular maintenance is involved. Luckily, it's spread out throughout the calendar year, and can be easily incorporated into your normal workflow of planting and composting and weeding and watering and harvesting and canning and feeding chickens and gathering eggs and making jam and fixing the gate and building a tool shed and figuring out what's eating your tomatoes and deciding whether goats are a good idea and coming up with a better way to collect all the rainwater that's just being wasted when it falls on the driveway. (Homesteading is fun, right?)

This chapter lays out a year's worth of what you should be doing for your colony of backyard bees, season by season. It also gets to the sweet and sticky reason why you got into bees to begin with: honey. You learn how to harvest every last drop, whether you're keeping it all for yourself, treating friends and family at gift-giving season, or bottling it for sale as a side business. Finally, every beekeeper needs to be on the lookout for certain problems and diseases that could threaten your hive. This chapter gets you started on keeping your colony healthy and happy.

Busying Yourself with Bee Activity

The seasonal calendar of events in Maine obviously looks different than one in Southern California. But different climates mean different schedules and activities for the hive and beekeeper. Regardless of their precise location, honey bees are impacted by the general change of seasons. Knowing what major activities are taking place within the hive and what's expected of you during these seasons is useful. For a good beekeeper, *anticipation* is the key to success.

This section contains a suggested schedule of seasonal activities for the beekeeper. However, you must note that geography, weather, climate, neighborhood, and even the type of bees influence the timing of these activities. The checklist is written from the viewpoint of a beekeeper experiencing a distinct change in seasons and climate (spring, summer, autumn, winter).

Lazy, hazy, crazy days of summer

Nectar flow usually reaches its peak during summer. That's also when the population of the colony usually reaches its peak. When that's the case, your colonies are quite self-sufficient, boiling with worker bees tirelessly collecting pollen, gathering nectar to convert into honey, and building beeswax comb to store both. Note, however, that the queen's rate of egg laying drops during the late summer. And on hot and humid nights, you may see a huge curtain of bees hanging on the exterior of the hive. Don't worry; they're not running away. They're simply cooling off on the front porch. It's called *bearding* (see Figure 2-1).

Late in summer the colony's growth begins to diminish. Drones are still around, but outside activity begins slowing down when the nectar flow slows. Bees seem to be restless and become protective of their honey.

TIP

A top bar hive colony will sometimes build honeycomb on both sides of the brood nest. This behavior can lead to the colony becoming "honey bound" with no place for the queen to lay. As you inspect your top bar hive colony and notice this behavior, you can simply move the honeycombs toward the rear and insert a few blank bars. This will allow the brood to continue to expand and also help control the urge to swarm.

Your summer time commitment: You can't do all that much until the end of the summer and the honey harvest because your bees are doing it all! Figure on spending about eight to ten hours with your bees during the summer months. Most of this time involves harvesting and bottling honey.

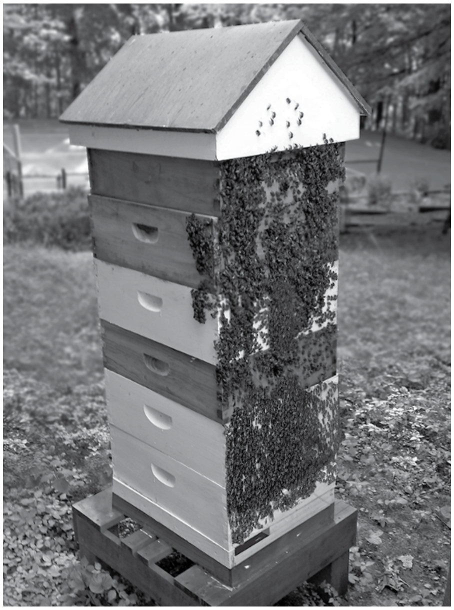


FIGURE 2-1: On a summer evening, the bees are cooling off on the exterior of a hive.

Courtesy of Howland Blackiston

Harvest your honey crop at the end of the nectar flow. Remember that in zones experiencing cold winters, the colony requires at least 60 pounds of honey for use during winter.

Falling leaves point to autumn chores

Most nectar and pollen sources become scarce as days become shorter and weather cools in autumn. All in all, as the season slows down, so do the activities within your hive: The queen's egg-laying is dramatically reduced, drones begin to disappear from the hive, and hive populations drop significantly.

Your bees begin bringing in propolis, using it to chink up cracks in the hive that may leak the winter's cold wind. The colony is hunkering down for the winter, so you must help your bees get ready.

Feed your colony. They'll accept a 2-to-1 sugar-syrup feeding (see the "Autumn syrup recipe") until colder weather contracts them into a tight cluster. At that point, temperatures are too cold for them to leave the cluster, so they are likely to ignore your offering.

Keep feeding your bees until they stop taking the syrup, or until the temperature drops, and they form the winter cluster. A hive-top feeder works best. If you are medicating, the first 2 gallons should be medicated with Fumigilin-B — subsequent feedings are not medicated.

If you're in a climate where the winter gets below freezing for more than several weeks, wrap the hive in black tar paper (the kind used by roofers). Make sure you don't cover the entrance or any upper ventilation holes. The black tar paper absorbs heat from the winter sun and helps the colony better regulate temperatures during cold spells. It also acts as a windbreak. This kind of wrap can be done on either a Langstroth hive or a top bar hive.

Place a rock on top, as shown in Figure 2-2, to keep the paper from blowing off. The metal mouse guard keeps unwanted visitors out, and the hole in the upper deep aids ventilation.

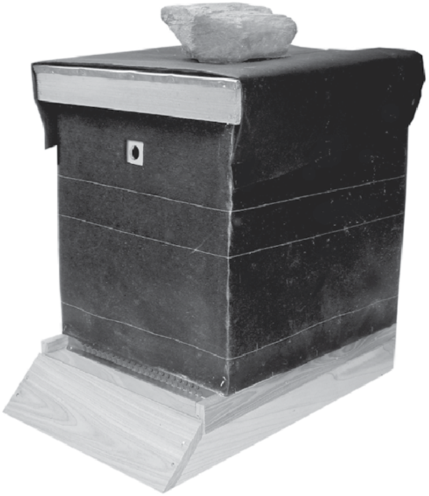


FIGURE 2-2: Wrap your hive in tar paper to protect your colony from harsh winter winds and absorb the warmth of the sun.

Courtesy of Howland Blackiston

Your autumn time commitment: Figure on spending three to five hours total to get your bees fed and bedded down for the winter months ahead.

Clustering in a winter wonderland

A lot goes on inside the hive during the winter. The queen is surrounded by thousands of her workers — kept warm in the midst of the winter cluster. The winter cluster starts in the brood chamber when ambient temperatures reach 54 to 57 degrees (12 to 14 degrees Celsius). When cold weather comes, the cluster forms in the center of the two hive bodies. It covers the *top* bars of the frames in the lower chamber and extends over and beyond the *bottom* bars of the frames in the food chamber (see Figure 2-3).

AUTUMN SYRUP RECIPE

Use a special heavy syrup for feeding bees that are about to go into the winter months. A thicker-consistency recipe makes it easier for bees to convert the syrup into the capped honey they'll store for the winter.

Boil 2½ quarts of water on the stove. When it comes to a rolling boil, turn off the heat and add 10 pounds of white granulated sugar. Be sure you turn off the stove. If you continue boiling the sugar, it may caramelize, and that makes the bees sick. Stir until the sugar dissolves completely. The syrup must cool to room temperature before you can add medication. Note that this is a recipe for thicker syrup than that used for feeding bees in the spring.

If you see clear evidence of nosema (you'll notice mustard brown drips on the hive and at the entrance), you may want to medicate your syrup. A colony with nosema will have a hard time surviving the winter. To medicate the syrup, mix 1 teaspoon of Fumigilin-B in approximately a half cup of lukewarm water (the medication won't dissolve in the syrup). Add the medication to the syrup and stir. Only the first two gallons you feed your bees need to be medicated. Subsequent batches do not need to be medicated.

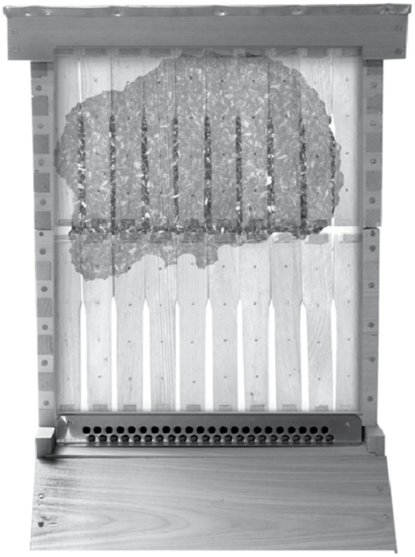


FIGURE 2-3: This cutaway illustration shows the winter cluster's position.

Courtesy of Howland Blackiston

Although the temperature outside may be freezing, the center of the winter cluster remains between 90 and 93 degrees (32 and 34 degrees Celsius). The bees generate heat by "shivering" their wing muscles.

No drones are in the hive during winter, but some worker brood begin appearing late in the winter. Meanwhile, the bees consume about 50 to 60 pounds of honey in the hive during winter months. They eat while they are in the cluster, moving around as a group whenever the temperature gets above 40 to 45 degrees (4 to 7 degrees Celsius). They can move to a new area of honey only when the weather is warm enough for them to break cluster.

Bees won't defecate in the hive. Instead, they hold off until they can leave the hive on a nice, mild day when the temperature reaches 45 to 50 degrees (7 to 10 degrees Celsius) to take *cleansing flights.*

Make sure the bees have enough food! The late winter and early spring are especially hazardous because during this time colonies can die of starvation.

Late in the winter, on a nice, mild day when there is no wind and bees are flying, take a quick peek inside your hive. It's best not to remove any frames. Just have a look-see under the cover. Do you see bees? They still should be in a cluster in the upper deep. Are they okay?

REMEMBER

If you don't notice any sealed honey in the top frames, you may need to begin some emergency feeding. But remember that once you start feeding, you *cannot* stop until the bees are bringing in their own pollen and nectar.

Your winter time commitment: During this time, the bees are in their winter cluster, warm inside the hive. Figure on spending two to three hours repairing stored equipment.

Spring is in the air

Spring is one of the busiest times of the year for bees (and beekeepers). It's the season when new colonies are started and established colonies come back to life.

Days are getting longer and milder, and the established hive comes alive, exploding in population. The queen steadily lays more and more eggs, ultimately reaching her greatest rate of egg-laying. The drones begin reappearing, and hive activity starts hopping. The nectar and pollen begin coming into the hive thick and fast. The hive boils with activity.

Conduct an early-bird inspection. Colonies should be given a quick inspection as early in the spring as possible. The exact timing depends on your location (earlier in warmer zones, later in colder zones).

You don't need to wait until bees are flying freely every day nor until the signs of spring are visible (the appearance of buds and flowers). Do your first spring inspection on a sunny, mild day with *no wind* and a temperature close to 50 degrees (10 degrees Celsius).

TIP

A rule of thumb: If the weather is cold enough that you need a heavy overcoat, it's too cold to inspect the bees.

Determine that your bees made it through the winter. Do you see the cluster? The clustered bees should be fairly high in the upper deep hive body. If you don't see them, can you hear the cluster? Tap the side of the hive, put your ear against it, and listen for a hum or buzzing.

If it appears that you've lost your bees, take the hive apart and clean out any dead bees. Reassemble it and order a package of bees as soon as possible. Don't give up. All beekeepers lose their bees at one time or another.

Check to make sure you have a queen. If your hive has a live colony, look down between some of the frames. Do you see any brood? That's a good sign that the queen is present. To get a better look, you may need to carefully remove a frame from the center of the top deep. Can you see any brood? Do you spot any eggs?

WARNING

This inspection must be done quickly because you don't want to leave the frame open to chilly air. If you don't see any brood or eggs, your hive may be without a queen, and you should order a new queen as soon as possible, assuming, that is, the hive population is sufficient to incubate brood once the new queen arrives. What's sufficient? The cluster of bees needs to be *at least* the size of a large grapefruit (hopefully larger). If you have fewer bees than that, you should plan to order a new package of bees (with queen).

Check to ensure the bees still have food. Looking down between the frames, see if you spot any honey. Honey is capped with white cappings (tan cappings are the brood). If you see honey, that's great. If not, you must begin emergency feeding your bees.

Feed the colony. A few weeks before the first blossoms appear, you need to begin feeding your bees (regardless of whether they still have honey.

Reverse your hive bodies. See the upcoming "Reversing hive bodies" section.

Your spring time commitment: Spring is just about the busiest time for the beekeeper. You can anticipate spending 8 to 12 hours tending to your bees.

Reversing hive bodies

Bees normally move upward in the Langstroth hive during the winter. In early spring, the upper deep is full of bees, new brood, and food. But the lower deep hive body is mostly empty. You can help colony expansion by reversing the top and bottom deep hive bodies (see Figure 2-4). Doing so also gives you an opportunity to clean the bottom board.

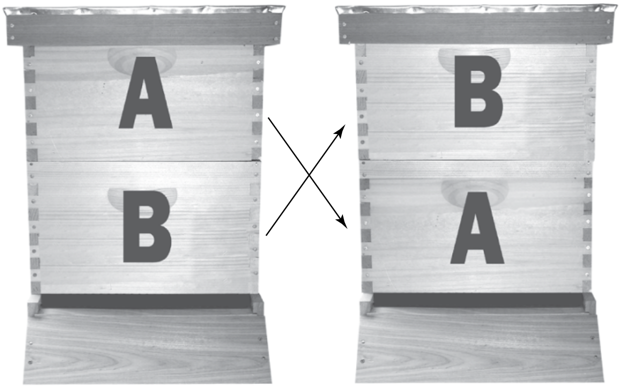


FIGURE 2-4: Reversing hive bodies in the spring helps to better distribute brood and food.

Illustration by Howland Blackiston

Follow these steps:

1. **When a mild day comes along (50 degrees [10 degrees Celsius]) with little or no wind and bright, clear sunlight, open your hive using your smoker in the usual way.**
2. **Place the upturned outer cover on the ground and then remove the upper deep hive body with the inner cover in place.**
3. **Place the deep across the edges of the outer cover so there are only four points of contact (you'll squeeze fewer bees that way).**
4. **Close the oval hole in the middle of the inner cover with a piece of wood shingle or tape.**

   Now you can see down into the lower deep that still rests on the bottom board.
5. **The lower deep is probably empty, but even if some inhabitants are found, lift the it off the bottom board and place it crossways on the inner cover that is covering the deep you previously removed.**

6. **Scrape and clean the bottom board.**

   Note: This is a good opportunity to add a slatted rack. Slatted racks help with the hive's ventilation and can promote superior brood patterns. They also encourage the queen to lay eggs all the way to the front of the hive because of improved ventilation and draft control.

7. **Now stand the deep body — which had been the relatively empty bottom one — on one end, placing it on the ground.**
8. **Place the full hive body (the one that had been on top) onto the clean bottom board (or on the slatted rack, if you added one).**
9. **Smoke the bees and remove the inner cover so you can place the empty deep (the box that had been the lowest) on top.**
10. **Replace the inner and outer covers.**

This reversing procedure enables the bees to better distribute brood, honey, pollen, fresh nectar, and water. Reversing gives them more room to move upward, which is the direction they always want to move.

Repeat this reversal in about three to four weeks, restoring the hive to its original configuration. At that time you can add one or more honey supers above the two brood boxes — assuming the bees are now bringing in their own food and you have ceased feeding.

Expanding the brood nest

Springtime is all about colony expansion. Your top bar hive will begin to build out brood in the direction of the entrance. With incoming nectar and pollen, your job will be to ensure that the brood nest has plenty of room to expand by supplying new bars as needed or by moving the follower board so you always have two to three empty top bars waiting for bee expansion. Observe what your colony is doing and insert either blank bars or more drawn comb from the previous season. If the colony feels it has run out of room to raise brood, it may decide to initiate a swarm.

Holding Out for Honey

It all comes down to honey. That's why most people keep bees. For eons honey has been highly regarded as a valuable commodity. And why not? No purer food exists in the world. It's easily digestible, a powerful source of energy, and simply delicious. In many countries, honey even is used for its medicinal properties. The honey bee is the only insect that manufactures a food we eat. And we eat a lot of it — more than 1 million tons are consumed worldwide each year.

What a thrill it is to bottle your first harvest! You'll swear that you've never had honey that tastes as good as your own. And you're probably right. Commercial honey can't compare to homegrown. Most supermarket honey has been cooked and ultra-filtered; these processes make the product more visually attractive for commercial sale. And alas, some commercial honey isn't even pure honey, having been blended with less-expensive sweeteners to increase profits. Yours will be just the way the bees made it — pure, natural, and packed with aroma and flavor.

Having realistic expectations

In your first year, don't expect too much of a honey harvest from your Langstroth hive. Sorry, but a newly established colony doesn't have the benefit of a full season of foraging. Nor has it had an opportunity to build its maximum population. That's disappointing new, but be patient. Next year will be a bonanza!

Table 2-1 gives you a rough calculation for determining how much honey is in your hive.

TABLE 2-1 Estimating Honey Yields

Type of Honeycomb	Estimated Honey Capacity (Per Comb)
Langstroth deep frame	6 pounds
Langstroth medium frame	4 pounds
Langstroth shallow frame	3 pounds
Warré top bar	3 to 4 pounds*
Kenyan top bar	4 to 6 pounds*

**Estimating honey yield in top bar hives is difficult because they vary in length and the free-form construction of the honeycomb can vary considerably.*

Beekeeping is like farming. The actual yield depends on the weather. Many warm, sunny days with ample rain result in more flowers and greater nectar flows. When gardens flourish, so do bees. If Mother Nature works in your favor, a hive can produce 60 and even up to 100 pounds of surplus honey (that's the honey you can take from the bees). If you live in a warm climate (such as Florida or Southern California), you can expect multiple harvests each year. But remember that your bees need you to leave some honey for their own use. In cold climates, leave them 60 pounds; in climates with no winter, leave 20 to 30 pounds.

Assembling the essential extracting equipment

You need to get the appropriate kind of equipment. This section discusses the various types that you need to extract honey. *Extracted honey* refers to honey that is removed from wax comb. The honey is bottled in a liquid form, as opposed to harvesting comb or chunk honey where the honey isn't removed from the wax comb before it's packaged.

REMEMBER

Harvesting *extracted* honey is easier for you and the bees, and you're far more likely to get a substantial crop than if you were trying to produce *comb* honey. Comb honey requires picture-perfect conditions to realize a successful harvest (large hive population, hard-working and productive bees, ideal weather conditions, and excellent nectar flows).

Honey extractors

An extractor spins honey from the comb using centrifugal force (see Figure 2-5). Extractors come in different sizes and styles to meet virtually every need and budget. Hand-crank models or ones with electric motors are available. Small ones for the hobbyist with a few hives, huge ones for the bee baron with many hives, and everything in between can be found. Budget extractors are made entirely of plastic, while rugged ones are fabricated from food-grade stainless steel.

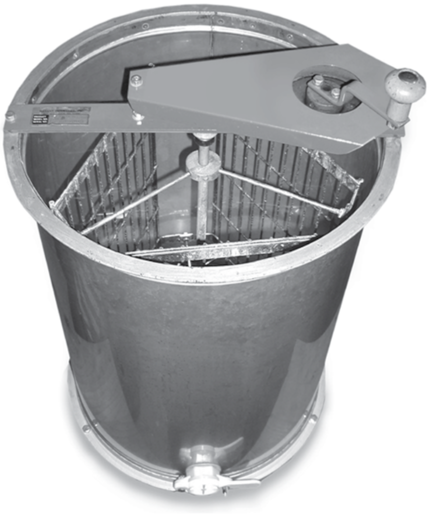


FIGURE 2-5: This hand-crank stainless-steel extractor can extract up to six shallow frames at a time.

Courtesy of Howland Blackiston

Uncapping knife

The wax cappings on the honeycomb form an airtight seal on the cells containing honey — like a lid on a jar. Before honey can be extracted, the lids must be removed. The easiest way is by using an electrically heated uncapping knife. These heated knives slice quickly and cleanly through the cappings (see Figure 2-6).

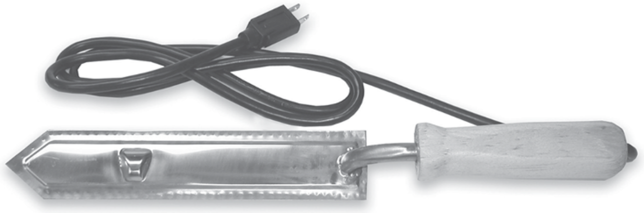


FIGURE 2-6: An electrically heated uncapping knife makes short order of slicing wax cappings off honeycomb.

Courtesy of Howland Blackiston

Honey strainer

The extracted honey needs to be strained before you bottle it. This step removes the little bits of wax, wood, and the occasional sticky bee. Any kind of conventional kitchen strainer or fine-sieved colander will suffice. Nice stainless-steel honey strainers (see Figure 2-7) are made just for this purpose and are available from your beekeeping supplier.

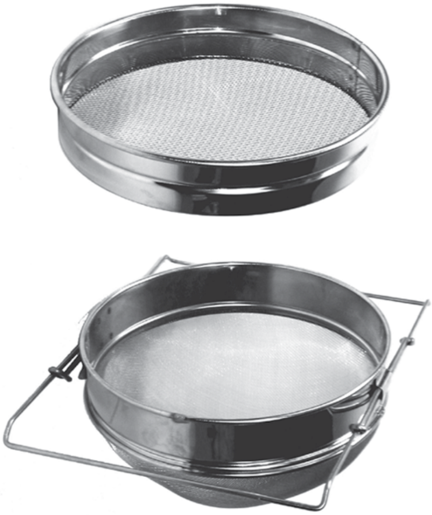


FIGURE 2-7: A double stainless-steel honey strainer (like this one) is an effective way to clean up your honey before bottling it.

Courtesy of Howland Blackiston

TIP

Or you can use a disposable cloth paint strainer (available at your local paint supply store). It does the trick just fine and fits nicely over a five-gallon, food-grade plastic bucket.

Harvesting Your Honey

The day you've anticipated all year is finally here, and it's time to reap the rewards of all your efforts (actually the bees did most of the work, but go ahead and take the credit anyway). It's time for the honey harvest!

Knowing when to harvest

In general, beekeepers harvest their honey at the conclusion of a substantial nectar flow and when the hive is filled with cured and capped honey (see Figure 2-8). Note that the Langstroth frame (top figure) supports the sides and bottom, but the top bar hive (bottom figure) has no such support for its delicate comb.

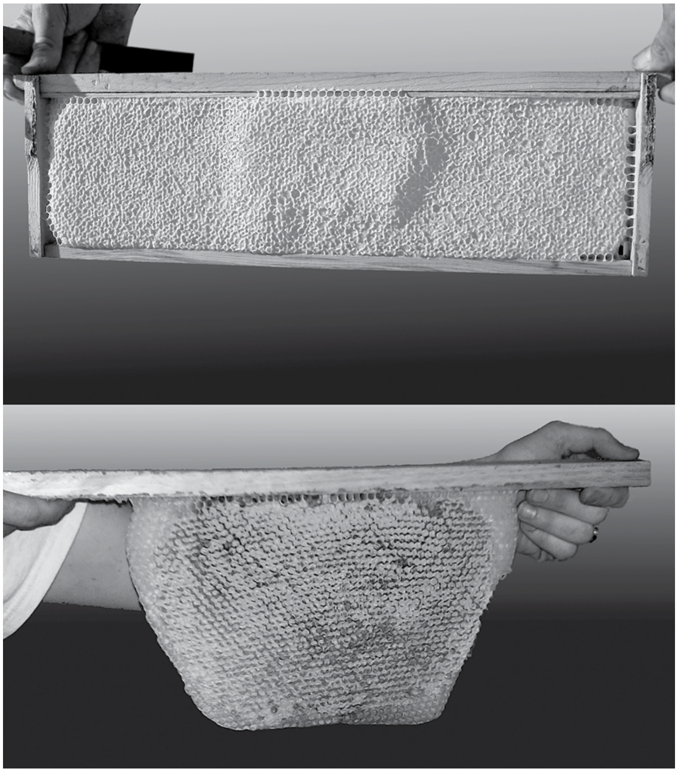


FIGURE 2-8: A frame of comb from a Langstroth hive (top) and honeycomb from a top bar hive (bottom).

Courtesy of Howland Blackiston with Jasmine and Zack Cecelic, `www.wildhoodfarm.com`

Take a peek under the hive cover every couple of weeks during summer. Check in the honey supers that you placed on the hive earlier in the season. Note what kind of progress your bees are making and find out how many of the frames are filled with capped honey.

When a frame contains 80 percent or more of sealed, capped honey, you're welcome to remove and harvest this frame. Or you can practice patience — leave your frames on and wait until one of the following is true:

- The bees have filled all the frames with capped honey.
- The last major nectar flow of the season is complete.

WARNING

Don't leave the honey supers on the hive too long! After the last major nectar flow, with winter looming on the distant horizon, the bees will start to eat much of the honey you'd hoped to harvest. Or they will start moving it to open cells in the lower deep hive bodies. Either way, you've lost the honey that should have been yours. And if the weather turns too cold, the honey will thicken or even granulate and become impossible to extract from the comb.

Planning your extracted honey harvest setup

Giving some thought to where you plan to extract and bottle your honey is important. You can use your basement, garage, tool shed, or even your kitchen. You don't need a big area. The guidelines in the following list will help you choose the best location:

- The space you choose must be absolutely bee-tight. That is to say, you don't want any bees getting into the space where you're working. The smell of all that honey will attract them, and the last thing you want is hundreds (or thousands) of ravenous bees flying all about.
- Never, ever attempt to harvest your honey outdoors. If you do, disaster is imminent! In short order you'll be engulfed by thousands of bees, drawn by the honey's sweet smell.
- Set up everything in advance, and arrange your equipment in a way that complements the sequential order of the extraction process (see Figure 2-9).
- Have a bucket of warm water — better yet, hot and cold running water — and a towel at the ready. Life gets sticky when you're harvesting honey, and the water is a welcome means for rinsing off your hands and uncapping knife.

WARNING

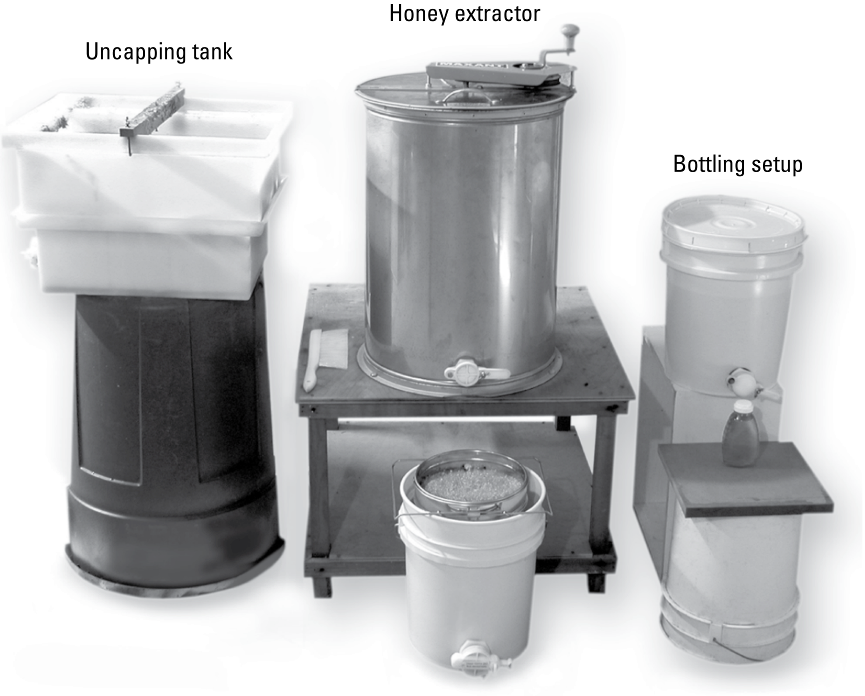


FIGURE 2-9: Here's a typical setup, left to right, for extracting honey.

Courtesy of Howland Blackiston

- If you're using an electric uncapping knife, you'll need an electrical outlet. But remember that water and electricity don't mix well, so be careful!
- Place newspapers or a painter's drop cloth on the floor. This little step saves time during cleanup. If your floor is washable, that really makes life easy!

Getting the bees out of the honey supers

Regardless what kind of hive you have (frames or top bars), you must remove the bees from the honeycomb before you can extract or remove the honey.

Removing bees from honeycomb can be accomplished in many different ways. Before attempting any of these methods, be sure to smoke your bees the way you normally would when opening the hive for inspection.

WARNING

The bees are protective of their honey during this season. Besides donning your veil, now's the time to wear your gloves. If you have somebody helping you, be sure he is also adequately protected.

Shakin' 'em out

This bee-removal method involves removing frames (one by one) from honey supers and then shaking the bees off in front of the hive's entrance (see Figure 2-10). The cleared frames are put into an empty super. Be sure that you cover the super with a towel or board to prevent bees from robbing you of honey. You can use a bee brush to gently coax any remaining bees off the frames.

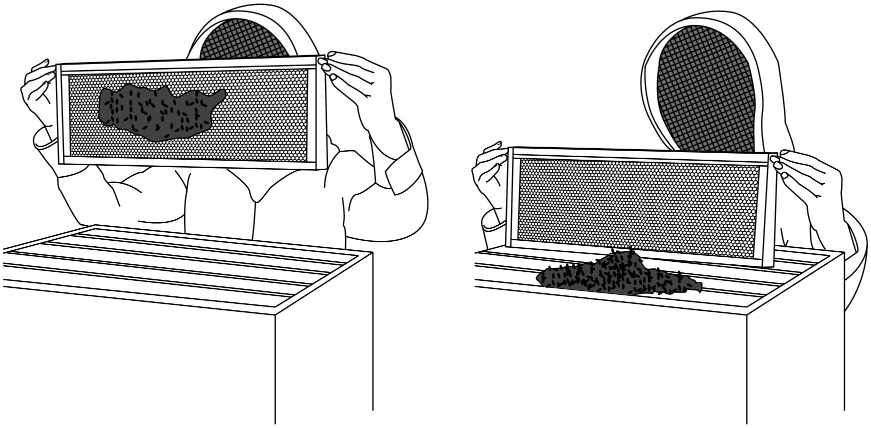


FIGURE 2-10: Shaking bees off a Langstroth frame.

WARNING

Don't try to shake bees off top bar comb because the wax comb is not secured with a wooden frame (unlike a Langstroth frame). The unsupported comb on a top bar is very delicate. The shaking method will likely break the comb apart, so it's best to use the bee brush method to remove bees from the comb.

Shaking and brushing bees off frames aren't the best options for the new beekeeper because they can be quite time-consuming, particularly when you have a lot of supers to clear. Besides, the action can get pretty intense around the hive during this procedure. The bees are desperate to get back into those honey frames, and, because of their frenzy, you can become engulfed in a fury of bees. Don't worry — just continue to do your thing. The bees can't really hurt you, provided you're wearing protective gear.

Blowin' 'em out

One fast way to remove bees from Langstroth supers (not recommended for top bar hives) is by blowing them out. Rest assured, they don't like it much. Honey supers are removed from the hive (bees and all) and stood on end. By using a special bee blower (or a conventional leaf blower), the bees are blasted from the frames at 200 miles an hour. Although it works, to be sure, the bees wind up disoriented and *very* irritated. So again, this method is not recommended for the novice beekeeper.

Fume board and bee repellent

A *fume board* looks like an outer cover with a flannel lining. A liquid bee repellent is applied to the flannel lining and the fume board is placed on top of the honey supers (in place of the inner and outer covers). Within five minutes, the bees are repelled out of the honey supers and down into the brood chamber. Instant success! The honey supers can then be safely removed and taken to your harvesting area.

TIP

This approach can be used for Langstroth- and Warré-style hives. It will not work with a Kenyan top bar hive.

TIP

Keep in mind that a shallow super full of capped honey and frames can weigh 40 pounds. You'll have a heavy load to move from the beeyard to wherever you'll be extracting honey. So be sure to save your back and take a wheelbarrow or hand truck with you when removing honey supers from the hive. Figure 2-11 shows a hive carrier.

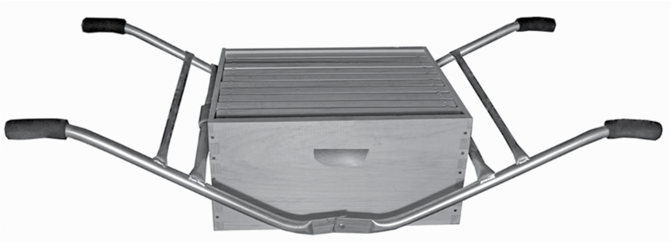


FIGURE 2-11: If you have a friend to help, a hive carrier like this makes carrying heavy supers and hive bodies much easier.

Courtesy of Howland Blackiston

Honey extraction from a Langstroth frame

After the bees are out of the honey supers, prepare to process your honey as soon as possible (within a few days). Doing so minimizes the chance of a wax moth infestation. Besides, extracting honey is easier to do when the honey is still warm from the hive because it flows much more freely.

Harvesting honey using an extractor

Follow this procedure when extracting honey from your Langstroth-style frames:

1. **One by one, remove each frame of capped honey from the super.**

   Hold the frame vertically over the double uncapping tank and tip it slightly forward. This helps the cappings fall away from the comb as you slice them.

2. **Use your electric uncapping knife to remove the wax cappings and expose the cells of honey.**

   A gentle side-to-side slicing motion works best, like slicing bread. Start a quarter of the way from the bottom of the comb, slicing upward (see Figure 2-12). Keep your fingers out of harm's way in the event the knife slips. Complete the job with a downward thrust of the knife to uncap the cells on the lower 25 percent of the frame.

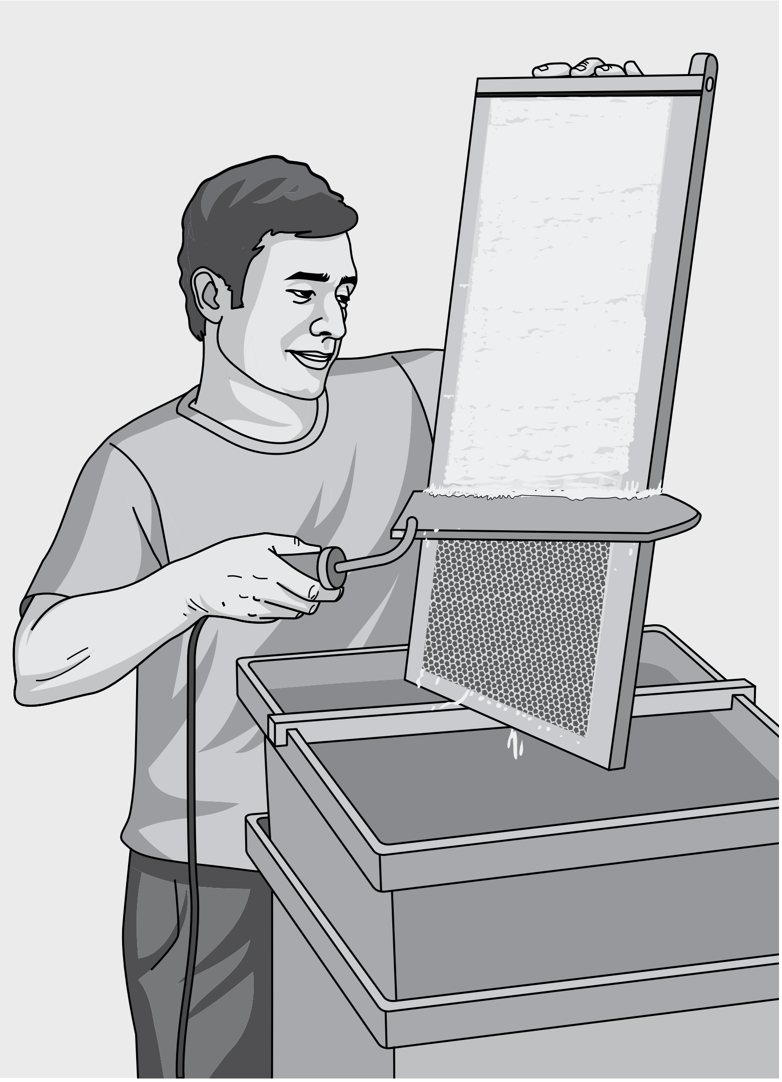


FIGURE 2-12: Remove wax cappings using an electric uncapping knife.

3. **Use an uncapping fork (also called a cappings scratcher) to get any cells missed by the knife.**

   Flip the frame over, and use the same technique to do the opposite side.

4. **When the frame is uncapped, place it vertically in your extractor (see Figure 2-13).**

   An extractor is a device that spins the honey from the cells and into a holding tank.

   After you've uncapped enough frames to fill your extractor, put the lid on and start cranking. Start spinning slowly at first, building some speed as you progress. Build speed gradually, without initially spinning the frames as fast as you can because extreme centrifugal force may damage the delicate wax comb. After spinning for five to six minutes, turn all the frames to expose the opposite sides to the outer wall of the extractor. After another five to six minutes of spinning, the comb will be empty. The frames can be returned to the shallow super.

5. **As the extractor fills with honey, it becomes increasingly difficult to turn the crank (the rising level of honey prevents the frames from spinning freely), so you need to drain off some of the harvest.**

   Open the valve at the bottom of the extractor and allow the honey to filter through a honey strainer and into your bottling bucket.

6. **Wait about an hour before bottling.**

   This resting period allows any remaining wax pieces and air bubbles to rise to the top.

Cleaning frames after extracting

Never store extracted frames while they're wet with honey. You'll wind up with moldy frames that have to be destroyed and replaced next year. You have to clean up the sticky residue on the extracted frames. How? Let the bees do it!

At dusk, place the supers with the empty frames on top of your hive (sandwiched between the top deep and the inner and outer covers). Leave the supers on the hive for a few days and then remove them (you may have to coax any remaining bees from the supers by shaking them off the frames, or by using a bee escape or fume board). The bees will lick up every last drop of honey, making the frames bone dry and ready to store until next honey season.

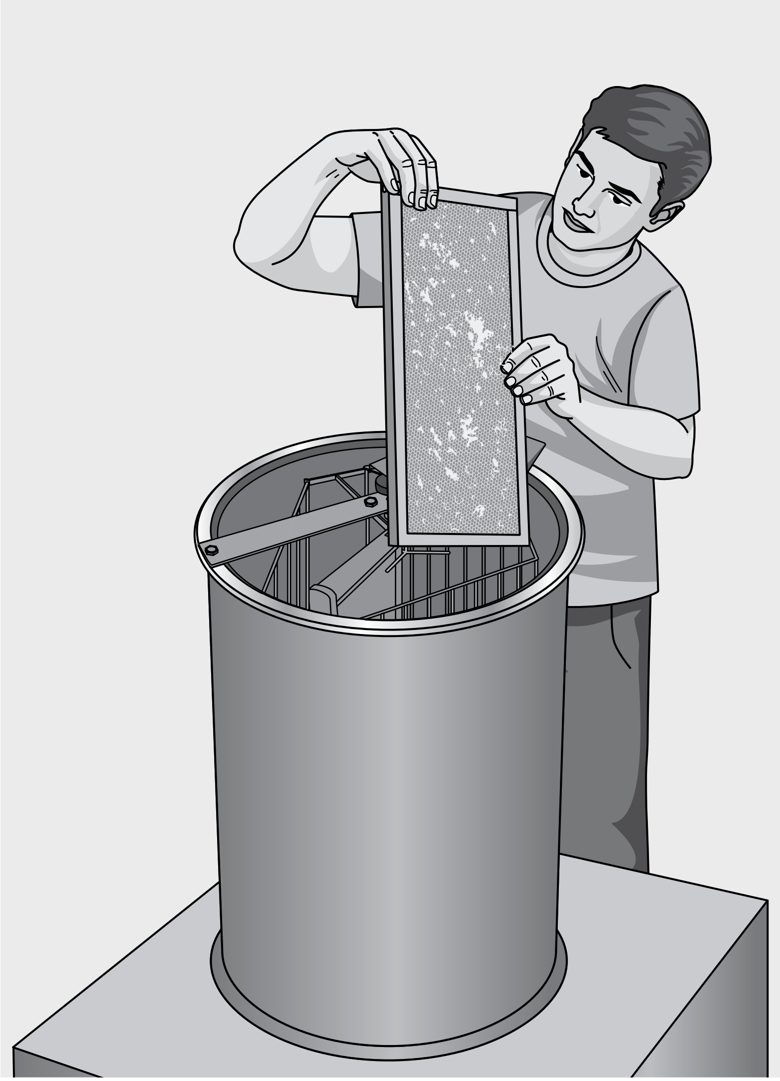


FIGURE 2-13: Place the uncapped frame vertically in the extractor.

Harvesting honey from your top bar hive

Before you can harvest honey from your top bar hive, you must determine whether your colony made excess honey and where it is in the hive.

REMEMBER

A top bar hive has honey stored in bands above the brood area on each comb. That honey is *not* part of the harvest and should be left for the bees' winter stores.

The honey you can harvest comes from those combs completely filled with honey and capped. Remember that these same capped honey stores can also be critical for the survival of the colony in winter. You must approach the harvest in a conservative way, always leaving enough to see the bees through the winter months.

Selecting the comb to harvest

The pure honeycombs are likely to be found farthest from the entrance. In the case of a front-entrance colony, that would be toward the back.

You may notice that some of the honeycombs are capped on top, but the bottom still has some open cells. Those cells will have a higher moisture content and are not suitable to be included in the harvest. If a significant amount of your comb is uncapped, your honey is not ready and should be left in the colony until it's capped.

If just a few rows at the bottom of a comb are not capped, you can harvest those combs and discard the uncapped cells or, better yet, eat them on the spot.

After you've identified what honeycombs you will take, the issue of handling the removed combs comes next. Top Bar combs filled with honey are very heavy and very fragile. The comb can break off the bar when mishandled. It is not recommended that you harvest on very hot days because the likelihood of breakage increases with higher temperatures. Build some kind of covered box or container that will allow you to transport the comb in a protected way to head off a robbing frenzy (see Figure 2-14).

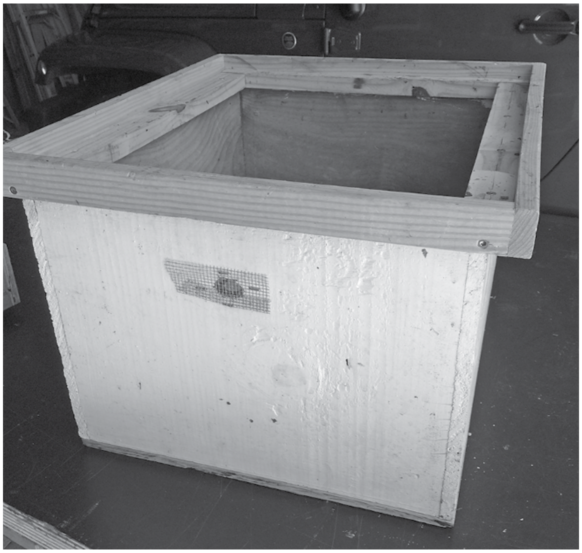


FIGURE 2-14: This box makes it easy to protect and transport comb.

Courtesy of William Hesbach

Harvesting using the crush-and-strain method

If you have just a few combs to harvest, your best option is to crush and strain them. The process is simple but decidedly messy. Slice or break a small section of comb off the top bar and squeeze it to release the honey. Use a clean pair of kitchen gloves to keep your hands from getting sticky. Keep squeezing until all the honey is out. At this point the comb will harden into a ball. Break the ball apart and leave it in the strainer. Continue until all your combs are crushed. Leave them to strain until no honey is dripping through the paint strainer. Once all your honey is strained, it's ready for you to jar or enjoy.

REMEMBER

Regardless of whether you use the crush-and-strain method or a honey press (see the following section) to extract your honey, the comb is destroyed and the bees will have to build new comb before they can store more honey. That's both a disadvantage and an advantage of top bar honey harvesting. The disadvantage is the time and resources that the bees have to expend to draw more comb. The advantage is that you will have fresh, new comb that ensures the purity of your honey products (pesticide buildup can occur on old comb used year after year, as can happen when spinning frames and extracting honey).

Harvesting honey using a honey press

The crush-and-strain method (see the preceding section) of gathering honey from your top bar hive is a sticky, messy job. If you have multiple top bar–style hives, such as Warré or Kenyan hives, and need to process lots of full honeycombs, the honey press procedure is quite simple:

1. **One by one, slice the comb off each top bar using a serrated bread knife or an electric uncapping knife.**

   Allow the entire comb (wax and capped honey) to drop into the honey press's container. Depending upon the size and style of your press, you are likely to get several entire combs into the hopper.

2. **When the hopper is filled, put the lid and screw mechanism in place.**

   Following the manufacturer's instructions (each brand is slightly different), apply pressure (using the screw mechanism; see Figure 2-15) to squeeze and crush the honey from the wax combs. The extracted honey will ooze through the metal or cloth filter, and you can capture it in a clean honey bucket.

3. **Remove the crushed wax, clean the filter, and repeat the process until all the combs have been processed.**

   This method for harvesting honey also harvests a lot of beeswax, so be sure to save and process the crushed wax. Check out Book 3, Chapter 4 for details on creating homemade candles from that beeswax.

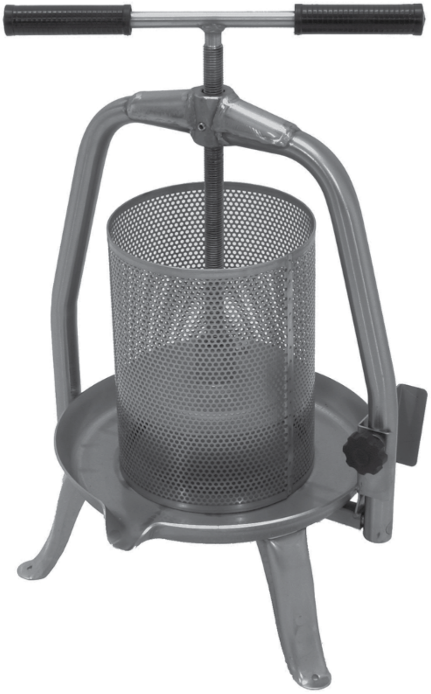


FIGURE 2-15: This is one style of honey press that is used for extracting honey from top bar hives.

Courtesy of Swienty Beekeeping

4. Return the now-empty top bars to their hive.

   The bees will need to rebuild new comb on these bars before they use them again next season.

Honey presses are not that easy to find, and they can be expensive. You are more likely to find honey presses from suppliers in Europe, where they are more commonly used. But if you are clever at building things, the Internet will turn up an array of plans for making your own.

ANTICIPATING BEE PROBLEMS

Despite the best intentions and the most careful planning, things occasionally go wrong. It happens. The bees swarm. The queen is nowhere to be found. The whole colony dies or flies away. That's nothing to be ashamed of. It's part of the process.

The key lesson is to *anticipate.* Discipline yourself to plan ahead and look out for potential problems *before* they happen. You can head off 80 to 90 percent of potential problems if you anticipate trouble and take steps to avoid it.

Swarming and Absconding

Sometimes bees disappear. They simply get up and go. Poof! In one common scenario, called *swarming,* about 50 percent of the colony packs up with the queen and takes flight. In the other scenario, called *absconding,* 100 percent of the colony hits the road, leaving not a soul behind. Neither scenario is something you want to happen.

Swarming

A swarm of honey bees is a familiar sight in the spring and early summer. It's one of the most fascinating phenomena in nature and an instinctive way that honey bees manage the colony's growth and survival. To witness a swarm pouring out of a hive is simply thrilling — though the pleasure may be less so if the swarm of bees is yours!

Starting about a week before swarming, the bees that intend to leave the colony gorge themselves with honey (like packing a box lunch before a long trip). Then, all at once, like someone flipped a switch, tens of thousands of bees exit the hive.

There's no telling where a swarm might land. It could land on any convenient resting place: a bush, a tree branch, a lamppost, or perhaps a piece of patio furniture. In any case, the swarming bees won't stay there long. As soon as scout bees find a more suitable and protected home, the swarm will be up, up, and away.

In its temporary resting place, the swarm is a bundle of bees clustered together for protection and warmth. Their queen is in the center of it all. Depending on the size of the hive that swarmed, the cluster may be as small as a grapefruit or as large as a watermelon. The bees will remain in this manner for a few hours or even a few days while scout bees look for a new home. When they return with news of a suitable spot, off they all go to take up residence in a hollow tree, within the walls of an old barn, or in some other cozy cavity.

If you're a first-year beekeeper, rest assured that a new colony is unlikely to swarm during its first season. But older and more crowded colonies are likely candidates for swarming behavior. Remember, swarming is a natural and normal instinct for bees. At one point or another, your bees will want to swarm. It's only natural. It's nature's way of reproduction. But discouraging them from doing so is a skill every beekeeper should have because a swarm means fewer bees to make honey for you.

The two primary reasons why bees swarm are congestion of the brood area and poor ventilation.

Avoiding congestion

Reverse your hive bodies in the early spring to better distribute the fast-growing population, and add a queen excluder and honey supers *before* the first nectar flow in the early spring to help prevent congestion.

Make sure to anticipate your bees' needs and provide them with more room *before* they need it. If you wait until it's obvious that the brood area is crowded, you're too late! The colony is likely to swarm, and there is little you can do to prevent them from swarming once they've set their minds to it.

Providing adequate ventilation

If your inner cover has a notched ventilation hole in the front of the inner cover, make sure it's open.

Use a short screw or piece of wood to create a spacer in each of the four corners of the inner cover. By doing so, you create a thin gap between the inner cover and the hive and improve airflow into and out of the hive.

Drill wine cork–sized holes in your upper deep (below the hand hold) and in all your honey supers, as shown in Figure 2-16. Doing so not only provides extra ventilation but also provides the bees with additional entrances.

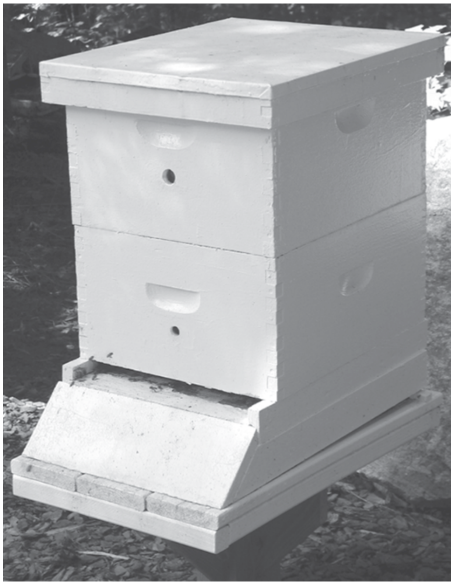


FIGURE 2-16: A useful way to provide a colony with ventilation is to drill wine-cork–sized holes in the hive bodies and supers.

Courtesy of Howland Blackiston

A week after your colony swarms, inspect the hive to determine whether it has a new queen. After the swarm, it will take one to seven days for the queen cell to open and a new virgin queen to emerge. Then allow a week or more for her to be ready to mate with drones. After mating, it will be another two days before she starts laying eggs. That's when you should start looking for eggs.

Do you see eggs? If so, you have a queen, and your colony is off and running. Close things up and celebrate. If there's still no sign of a queen or her eggs, wait a few days and check again. Still no eggs? Order a new queen from your bee supplier. Hive the replacement queen as soon as she arrives

WARNING

If you don't follow up after a swarm, the colony can easily become queenless without you ever being aware of it. No queen, no brood. No brood, no good.

Absconding

Absconding is a cruel blow when it happens. One day, you go to the hive and find no one home. Every last bee (or nearly every bee) has packed up and left town. Unlike a swarm, which leaves a portion of the colony behind, absconding leaves you with no bees at all.

Typical causes are lack of food, loss of the queen, a hive that's too hot or too wet, an insect infestation, an ongoing wildlife problem, mites and disease, or even colony collapse disorder, which will be discussed later in this chapter.

Playing Doctor: Fighting Disease

Nothing is more devastating than losing a colony to disease. But let's get real. Honey bees, like any other living creatures, are susceptible to illness. Although some of these diseases aren't too serious, some can be devastating.

But none of the health problems that affect bees have any effect on human health. These diseases are 100 percent unique to your bees. They're not harmful or contagious in any way to you or your family.

Medicating or not?

Should you put medication in your hive or not? Wouldn't keeping everything natural and avoiding the use of any chemicals, medications, or antibiotics be better? Maybe you can even save a few dollars. Or should you just take on the attitude of going for the "survival of the fittest"?

Well, do you avoid taking your dog to the vet for distemper shots and heartworm pills? Would you withhold antibiotics if your child came down with bronchitis? Probably not. Bees are no different. Without some help from you, they will eventually have a problem. You may even run the risk of losing your hive entirely. It need not be that way.

Follow a sensible health-check regime and look carefully for signs of trouble every time you inspect your colony. If things get serious, be prepared to judiciously apply remedies to prevent losing your colonies.

TIP

Here's the real key . . . be thoughtful regarding medicating. Unknowingly, many beekeepers have overdone it when it comes to bee health, administering medications "just in case" they might get sick. Don't do it. This kind of prophylactic regime has contributed to an increasing ineffectiveness of meds, antibiotics, and insecticides over recent years. If you choose to medicate, do so only when really necessary.

WARNING

Remember that you should never, ever medicate your bees when you have honey on the hive that is intended for human consumption.

Knowing the big six bee diseases

You should be on the lookout for six honey-bee diseases. Others are out there, but these six are the most common you may face.

Nosema

Nosema is the most widespread of adult honey-bee diseases and contributes increasingly to the weakening or demise of colonies. It was recently determined that there are *two* kinds of nosema, and they are quite different from each other.

Nosema apis is caused by a small, single-cell parasite but is classified as a fungus. nosema apis affects the intestinal tracks of adult bees — similar to dysentery in humans. It can weaken a hive and reduce honey production by between 40 and 50 percent. It can even wipe out a colony of bees. It's most common in spring after bees have been confined to the hive during the winter.

Symptoms include a slow-building colony in the spring, bees that shiver and crawl aimlessly around the front of the hive, and mustard-brown spotting and streaking of feces in and on the hive. The problem is that by the time these symptoms are visible, it has gone too far and is difficult or impossible to treat.

You can discourage nosema apis by selecting hive sites that have good airflow and a nearby source of fresh, clean water. Avoid damp, cold conditions that can encourage the fungus. Provide your hives with full or dappled sunlight. Creating an upper entrance for the bees during winter improves ventilation and discourages nosema apis. Purchase your bees and queens from reputable suppliers.

Nosema ceranae is also caused by a single-cell parasite, and it is also classified as a fungus. But the symptoms of nosema ceranae are not clear, which makes it difficult to identify just by observation. For example, no feces-spotting occurs in the hive. Only a microscopic analysis in the lab can confirm its presence of nosema ceranae. But the devastation on the colony is significant.

Nosema ceranae is relatively new and treatment protocols are still evolving. Beekeepers may want to subscribe to a bee journal and keep yourself informed regarding the latest news on nosema.

Chalkbrood

Chalkbrood is a common fungal disease that affects bee larvae. Chalkbrood pops up most frequently during damp conditions in early spring. It is rather common and usually not that serious. Infected larvae turn a chalky white color, become hard, and may occasionally turn black. You may not even know that your bees have it until you spot the chalky carcasses on the hive's "front porch." Worker bees on "undertaker duty" attempt to remove the chalkbrood as quickly as possible, often dropping their heavy loads at the entrance or on the ground in front of the hive.

No medical treatment is necessary for chalkbrood; your colony should recover okay on its own. But you can help your bees out by removing mummified carcasses from the hive's entrance and from the ground around the hive. Also, usually just one frame will have most of the chalkbrood cells.

Sacbrood

Sacbrood is a viral disease of brood similar to a common cold. It isn't considered a serious threat to the colony. Infected larvae turn yellow and eventually dark brown. They're easily removed from their cells, because they appear to be in a water-filled sack.

No recommended medical treatment exists for sacbrood. But you can shorten the duration of this condition by removing the sacs with a pair of tweezers. Other than that intervention, let the bees slug it out for themselves.

Stonebrood

Stonebrood is a fungal disease that affects larvae and pupae. It is rare and doesn't often show up. Stonebrood causes the mummification of brood. Mummies are hard and solid (not spongelike and chalky as with chalkbrood). Some brood may become covered with a powdery green fungus.

No medical treatment is needed for stonebrood. In most instances worker bees remove dead brood, and the colony recovers on its own. You can help things along by cleaning up mummies at the entrance and around the hive, and removing heavily infested frames.

American foulbrood (AFB)

American foulbrood (AFB) is a nasty bacterial disease that attacks larvae and pupae. This serious threat is highly contagious to bees and, left unchecked, is certain to kill your entire colony. It's the most terrible of the bee diseases.

Be on the lookout for larvae that has changed color from a healthy pearly white to tan or dark brown and die *after* they're capped. Check for cappings of dead brood that appear concave and possibly perforated, or have a wet and greasy appearance. And be aware of a capped brood pattern that is no longer compact, but spotty and random.

If you see these conditions, confirm that it's AFB by thrusting a toothpick or matchstick into the dead brood, mixing it around, and then *slowly* withdrawing the toothpick. Observe the material that is being drawn out of the cell as you withdraw the toothpick. Brood killed by AFB will be stringy and will *rope out* about ¼ inch (like pulling taffy) and then snap back like a rubber band. That test can confirm the presence of AFB.

If you suspect that your bees *have* AFB, immediately ask your state bee inspector or a seasoned local beekeeper to check your diagnosis. Treatment for AFB is subject to state law in the United States. If AFB is rampant, it is likely that your hives and equipment will have to be burned and destroyed. Why such drastic measures? Sleeping spores of AFB can remain active (even on old, unused equipment) for up to 70 years.

WARNING

Be wary of purchasing old, used equipment, no matter how tempting the offer may be or no matter how well you know the seller. If the bees that once lived in that hive ever had AFB, the disease-causing spores will remain in the equipment for decades. No amount of scrubbing, washing, sanding, or cleaning can remedy the situation. Start your new adventure in beekeeping by purchasing new and hygienic equipment.

European foulbrood (EFB)

Larvae infected with the bacterial disease *European foulbrood (EFB)* die *before* they're capped. It's not as horrific as AFB, but it's a problem that should be dealt with if you see signs of it.

Watch for a very spotty brood pattern (many empty cells scattered among the capped brood), sometimes referred to as a shotgun pattern. Capped cells may be sunken in and perforated, but the toothpick test won't result in the telltale ropy trail as described previously for AFB.

Infected larvae are twisted in their cells like an inverted corkscrew. The larvae are either a light tan or brown color and have a smooth, melted appearance as opposed to the glistening, bright white color of normal, healthy larvae.

Because EFB bacteria don't form persistent spores, this disease isn't as dangerous as AFB. Colonies with EFB sometimes recover by themselves after a good nectar flow begins. Although serious, EFB is *not* as devastating as AFB. There's no medical treatment for curing EFB once it has infected a colony, although there are products on the market (such as Tera Bee) that are sold as a preventative of EFB.

If you've detected EFB, re-queen your colony to break the brood cycle and allow the colony time to remove infected larvae. You can even help the bees by removing as many of the infected larvae as you can using a pair of tweezers.

Battling Varroa Mites

Somehow the little pest known as *Varroa destructor,* shown in Figure 2-17, has made its way from Asia to all parts of the world. Varroa has been a problem since the late 1980s (and maybe longer) and has created quite a problem for beekeepers. Resembling a small tick, this mite is about the size of a pinhead and is visible to the naked eye. And like a tick, the adult female mite attaches herself to a bee and feeds on its blood.

Mites attached to foraging worker bees enable the infestation to spread from one hive to another. They reproduce at a fantastic rate and cause a great deal of stress to the colony. The health of the colony can weaken to a point that bees become highly susceptible to viruses. Within a few seasons, the entire colony can be wiped out.

Symptoms of a varroa mite infestation include brown or reddish spots on the white larvae or a batch of newly emerged bees that appear badly deformed. If you actually *see* Varroa on adult bees (usually behind the head or nestled between the bee's abdominal segments), you already have a problem.

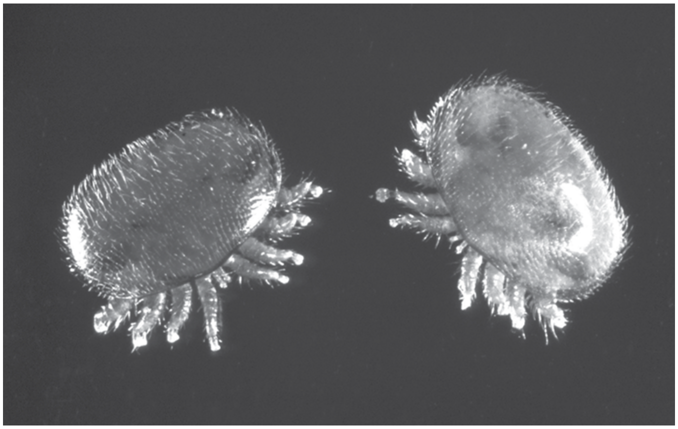


FIGURE 2-17: Varroa mites can seriously weaken a hive by attaching to bees and feeding on their blood.

Courtesy of USDA-ARS, Scott Bauer

Testing for varroa mites

If you suspect a Varroa mite problem, confirm your diagnosis with this simple test. The powdered-sugar-shake technique for detecting Varroa is effective, natural, and nondestructive (no bees are killed in the process). You can use this process in the early spring or later fall (when no honey supers are on the hives) as well as in summer (when supers are in place). Follow these steps:

1. **Obtain a 1-pint, wide-mouthed glass jar and modify the lid so it has a coarse screen insert. Just cut out the center of the lid and tape or glue a wire screen over the opening (see Figure 2-18).**

   Size #8 hardware cloth (eight wires to the inch) works well. Now you have something resembling a jumbo saltshaker.

2. **Scoop up about half a cup of live bees (about 200 to 300) from the brood nest and place them in the jar.**

   WARNING

   Don't scoop up the queen!

3. **Put 3 to 4 tablespoons of powdered sugar (confectioners' sugar) into the jar and then screw on the perforated lid.**

   Alternatively, you can use granulated sugar.

4. **Cover the screened lid with one hand (to keep the sugar from spilling out) and shake the jar vigorously for 30 to 60 seconds (like a bartender making a martini . . . shaken, not stirred).**

   TIP

   Shake your sugar cocktail authoritatively. Doing so dislodges any mites that are on the bees.

   This action doesn't really harm the bees, but it sure wakes them up!

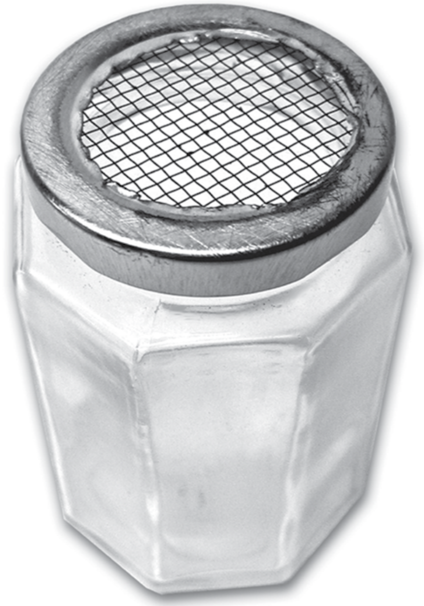


FIGURE 2-18: This jar's lid has been modified for a powdered-sugar-shake mite inspection.

Courtesy of Howland Blackiston

5. **Place the jar in a sunny spot for about a minute to allow the mites to drop off the bees; then give the jar another shake like before.**
6. **Shake all the sugar through the screened top and onto a white sheet of paper.**
7. **Open the top and deposit the bees onto the entry area of the colony (they are too covered with sugar to fly home). You may want to stand to the side because they will be rather unhappy. Shake any remaining sugar onto the paper.**
8. **Count the mites, which are easy to spot because they contrast with the white paper and white powdered sugar.**

If you count ten or more mites, you should proceed with the recommended treatment (see the next section, "Controlling Varroa mites"). Seeing many dozens of mites means the infestation has become significant. Take remedial action fast!

WARNING

Bees can be returned unharmed to the hive using this technique. Although they may be coated with sugar, their sisters will have a grand time licking them clean. Just wait 10 to 15 minutes to let them calm down before releasing them. All that jostling can make them understandably irritable — and revengeful.

Controlling varroa mites

Several techniques and products are available that help reduce or even eliminate Varroa mite populations:

- **Use drone comb to capture Varroa mites.** Bee suppliers sell a special drone foundation that has larger hexagons imprinted in the sheet. The bees will build drone comb only on these sheets. That's useful because Varroa mites prefer drone brood over worker brood. By placing a frame of drone comb in each of your hives, you can capture and remove many mites.

  After the drone cells are capped, remove the frame and place it overnight in your freezer. This kills the drone brood and the mites that have invaded the cells. Then uncap the cells and place the frame (with the dead drone brood and dead mites) back in the hive. The bees will clean it out, removing the dead drone brood and mites. The cells will get filled again, and you repeat the process.
- **Powdered-sugar dusting to control Varroa mites.** This technique involves dusting the bees with powdered sugar. The powdered sugar knocks many of the mites off the bees, and the mites fall down through the screened bottom board and perish in the grass below the hive (assuming you are using an elevated hive stand and a screened bottom board with the insert removed). Use this method continually during the season to help keep the mite populations below harmful levels.

Here's the process:

1. **On a day with low humidity, sift a pound of powdered sugar using a baking flour sifter.**

   Do this twice to ensure no lumps.
2. **Put the sifted sugar into an empty (and cleaned) baby-powder container (or something similar).**
3. **Smoke and open the hive. Then place a frame on the rest and do your dusting thing.**

   Remove frames one by one, and dust the bees with the sugar. Aim for light clouds of sugar dust — don't shake the sugar directly on the bees.
4. **Avoid dusting any open cells.**

   You just want to dust the backs of the bees.
5. **Put the dusted frame back into the hive and repeat this process with each frame.**
6. **When you're finished, put a little extra dusting along all the top bars.**

Repeat this process once a week for two to three weeks.

TIP

Both methods fall under the category of Integrated Pest Management (IPM), the practice of controlling pests with minimal chemicals. For more on IPM in the garden, check out Book 1, Chapter 4.)

A few effective and approved *synthetic miticide chemicals* (chemicals that kill mites) are available. One is fluvalinate, which is sold under the brand name *Apistan* and is available from your beekeeping supplier. Another is amitraz, sold under the brand name *Apivar,* and yet another is coumaphos (marketed as *CheckMite+*). Formic acid is also used as a treatment for tracheal mites (sold in plastic strips under the brand name *Mite Away Quick Strips*). In addition, there are "soft" (safer) chemicals such as thymol (marketed as *Apiguard*). Also consider oxalic acid (which sounds scary but is derived from plants). When using one of these treatments, be sure to carefully follow the directions on the package.

WARNING

Varroa mites aren't the only pest that can threaten your colony. Tracheal mites are another nasty parasite you may encounter. The bad news is that the only way to identify an infestation is by dissecting an adult bee and examining its trachea (breathing tube) under magnification. The good news is that a tracheal mite infestation is a problem, not a hopeless fate.

REMEMBER

Other pests that beekeepers need to be mindful of include wax moths, which can destroy wax comb; small hive beetles, which eat pollen, honey, bee brood, and eggs; ants, which can overrun a colony and force the bees to abscond; mice seeking warmth in the hive; and racoons and skunks, who love to eat bees. And believe it or not, bears are a genuine nuisance in more places than you might imagine.

Colony Collapse Disorder

Unless you have been living in a remote cabin on the side of a forgotten hill, you have likely noted that the media has been abuzz with news about "the vanishing bees".

In the autumn of 2006, a beekeeper in Florida filed the first report of a sudden and unexplained disappearance of his bees. They didn't die. They just packed up and left. More reports of heavy losses (mostly from commercial migratory beekeepers) quickly followed. In subsequent years, beekeepers have reported losing anywhere from 30 percent to 90 percent of their hives. Like a firestorm, this tragedy has swept across nearly all of the United States as well as some countries overseas. It has affected both commercial beekeepers and hobbyists. It is a far-reaching problem that has serious consequences.

Colony collapse disorder (CCD) is characterized by the sudden and unexplained disappearance of all adult honey bees in the hive, usually in the fall. In one scenario, a few young bees and perhaps the queen may remain behind while the adults disappear. Or in another scenario, there may be no bees left in the hive. Honey and pollen are usually present, and there is often evidence of recent brood rearing. This abrupt evacuation is ordinarily highly unusual because bees are not inclined to leave a hive if there is brood present.

Colonies that experience CCD have the following characteristics:

- All or nearly all of the bees pack up and leave within a two- to four-week time period. But there are no dead adult bodies.
- In some instances the queen and a small number of young-aged survivor bees are present in the brood nest. No bees or very few dead bees are in the hive or at the hive entrances.
- Capped brood is left behind.
- There is stored pollen and capped honey.
- Empty hives are *not* quickly invaded by opportunists (robbing bees, wax moths, small hive beetles, and so on).

Why is CCD making headlines? Well, a world without bees would be a vastly different world. Did you know that honey bees account for 30 percent of everything you eat? Commercial beekeepers provide honey bees to farmers all around the country to pollinate the crops that wind up in our supermarkets. If these pollinating mavericks were all to disappear, there would be reduced crop variety and most likely higher prices in your grocery store. No question about it. Honey bees are critical for agricultural pollination — adding more than $15 billion in value to about 130 crops — especially crops such as berries, nuts, fruits, and vegetables. The unexplained disappearance of so many colonies is not a matter to take lightly.

If you think your hives have fallen to CCD, don't panic. As a new beekeeper, you may be jumping to unwarranted conclusions. To date, CCD has been far more prevalent among commercial beekeepers, although losses among hobbyists like us happen sometimes.

TIP

If you believe you may have a problem, call your state's department of agriculture and ask to speak with the head bee inspector. He or she is likely to provide you with some helpful information. If you have records of the number of mites in your hive prior to the collapse, it will be helpful for the inspector to know.

No one knows for certain what’s causing CCD, at least not at the time of this writing. But researchers have managed to dismiss some “wild” theories and are now focusing on other, more probable causes. In all likelihood, CCD is not due to a single factor.

In a nutshell, several potential causes are being studied by scientists around the world: parasites (such as mites), pathogens (disease), environmental stresses (which include pesticides), and management stresses (including nutrition problems).

Don’t let all this gloomy news hinder your enjoyment of beekeeping. Although CCD is a serious concern for our honey bees, researchers are working on potential remedies. As mentioned earlier, becoming a backyard beekeeper is the single best thing you can do to help our honey bees. Embrace and enjoy this glorious hobby, and feel good about helping the honey bee get back on its feet. All six of them.

IN THIS CHAPTER

- **Deciding whether raising chickens is right for your homestead**
- **Comparing chicken types and breeds**
- **Thinking through your flock's space and housing requirements**

Chapter 3

Introducing Backyard Chickens

Chickens make colorful, moving lawn ornaments, and they can even furnish your breakfast. But they do take some attention, expense, and good information to care for properly.

For many, adding a flock of chickens is what truly turns a gardener into a homesteader. You're suddenly caring for a group of animals on your property and, in turn, feeding your family with what they produce. You're practically a farmer! While raising a flock of backyard chickens is one of the most enjoyable parts of homesteading for many, it's not a commitment to be taken lightly. There's plenty for you to consider beforehand to make sure that chicken-keeping is a fit for your family homestead.

This chapter helps you decide if a backyard flock is right or even feasible for you and then goes over various breeds to choose from. Lastly, special consideration is given to what you'll need to provide your flock in terms of housing — all the basics your chickens will expect in a coop.

Thinking Through Chickenkeeping

Before you become a chicken owner, you need to make some important decisions. Caring for a flock is different from bringing home a puppy or taking in a stray kitten, and quite frankly, it ends up not being right for everyone who tries it. A little planning goes a long way toward a good first attempt at raising chickens. Before you start compiling your favorite Sunday brunch recipes for all those fresh eggs you're envisioning, take some time to carefully consider if you and a flock of chickens will be a good match.

Dealing with legal issues

To know whether you can legally keep chickens, first you need to know the zoning of your property. Next, ask your government officials about any laws regarding keeping animals and erecting sheds or other kinds of animal housing in your zone. You need to be concerned about two types of laws and ordinances before you begin to raise chickens:

- **Laws concerning the ownership of animals at your home location:** Restrictions may cover the number of birds, the sex of the birds, and where on the property chicken coops can be located. In some areas, the amount of property you have and your closeness to neighbors may determine whether you can keep birds and, if so, how many. Your neighbor may own 5 acres and be allowed to keep chickens, but on your 2-acre lot, poultry may be prohibited. Or you may be allowed to keep so many pets per acre, including chickens. Or you may need to get written permission from neighbors. Many other rules can apply.
- **Laws that restrict the types of housing or pens you can construct:** Do you need a permit to build a chicken coop? Does it need to be inspected?

REMEMBER

Don't take the word of neighbors, your aunt, or other people not connected to local government that it's okay to raise chickens at your home. If you're in the midst of buying a home, don't even take the word of real estate agents about being able to keep chickens or even about the property zoning. You never know whether the information you're getting is legitimate when it comes from a secondary source, so it's best to go straight to the primary source of legal info.

Assessing your capabilities: basic chicken care and requirements

Chickens can take as much time and money as you care to spend, but you need to recognize the *minimum* commitments required to keep chickens. In the next sections, we give you an idea of what those minimums are.

Time

When we speak about time here, we're referring to daily caretaking chores. Count on a minimum of 15 minutes in the morning and in the evening to care for chickens in a small flock, if you don't spend a lot of time just observing their antics. Even if you install automatic feeders and waterers, a good chicken-keeper should check on the flock twice a day. If you have laying hens, collect the eggs once a day, which shouldn't take long.

Try to attend to your chickens' needs before they go to bed for the night and after they're up in the morning. Ideally, chickens need 14 hours of light and 10 hours of darkness. In the winter, you can adjust artificial lighting so that it accommodates your schedule. Turning on lights to do chores after chickens are sleeping is stressful for them.

You will need additional time once a week for basic cleaning chores. If you have just a few chickens, these chores may be less than an hour. The routine will include removing manure, adding clean litter, scrubbing water containers, and refilling feed bins. Depending on your chicken-keeping methods, you may need additional time every few months for more intensive cleaning.

Space

We devote an entire section of this minibook to the all-important chicken coop, and then provide step-by-step plans for building your own (in Book 5, Chapter 3). For now, here are some basic space requirements for your birds.

Each full-size adult chicken needs at least 2 square feet of floor space for shelter and another 3 square feet in outside run space if it isn't going to be running loose much. So a chicken shelter for four hens needs to be about 2 feet by 4 feet, and the outside pen needs to be another 2 feet by 6 feet, to make your total space used 2 feet by 10 feet (these dimensions don't have to be exact). For more chickens, you need more space, and you need a little space to store feed and maybe a place to store the used litter and manure. Of course, more space for the chickens is always better.

As far as height goes, the chicken coop doesn't have to be more than 3 feet high. But you may want your coop to be tall enough that you can walk upright inside it.

Besides the size of the space, you need to think about location, location, location. You probably want your space somewhere other than the front yard, and you probably want the chicken coop to be as far from your neighbors as possible, to lessen the chance that they complain.

Money

Unless you plan on purchasing rare breeds that are in high demand, the cost of purchasing chickens won't break most budgets. Adult hens that are good layers cost less than $10 each. Chicks of most breeds cost a few dollars each. Sometimes you can even get free chickens! The cost of adult fancy breeds kept for pets ranges from a few dollars to much, much more, depending on the breed.

Housing costs are extremely variable, but they are one-time costs. If you have a corner of a barn or an old shed to convert to housing and your chickens will be free-ranging most of the time, your housing start-up costs will be low — maybe less than $50. If you want to build a fancy chicken shed with a large outside run, your cost could be hundreds of dollars. If you want to buy a pre-built structure for a few chickens, count on a couple hundred dollars.

You may have a few other one-time costs for coop furnishings, including feeders, waterers, and nest boxes. For four hens, clever shopping should get you these items for less than $50.

TIP

Bargain hunters can often find used equipment online. Check websites such as Craigslist or eBay, or ask on neighborhood social networks (the modern-day "classifieds"). Lots of people go gung-ho raising chickens and then call it quits after just a year or two; you may be able to score a good bit of gently-used gear at a bargain price!

Commercial chicken feed is reasonably priced, generally comparable to common brands of dry dog and cat food. How many chickens you have determines how much you use: Count on about a third to a half pound of feed per adult, full-sized bird per day. We estimate the cost of feed for three to four layers to be less than $20 per month.

Focusing your intentions: specific considerations

You may be nostalgic for the chickens scratching around in Grandma's yard. You may have heard that chickens control flies and ticks and turn the compost pile. You may have children who want to raise chickens for a 4-H project. Maybe you want to produce your own quality eggs or organic meat. Or maybe you want to provoke the neighbors. People raise chickens for dozens of reasons. But if you aren't sure, it helps to decide in advance just why you want to keep chickens.

Egg layers, meat birds, and pet/show chickens have slightly different housing and care requirements. Having a purpose in mind as you select breeds and develop housing will keep you from making expensive mistakes and will make your chicken-keeping experience more enjoyable.

It's okay to keep chickens for several different purposes — some for eggs and others as show birds, for example — but thinking about your intentions in advance makes good sense.

Want eggs (and, therefore, layers)?

The egg that we enjoy with breakfast was meant to be food for a developing chick. Luckily for us, a hen continues to deposit eggs regardless of whether they have been fertilized to begin an embryo.

If you want layers, you need housing that includes nest boxes for them to lay their eggs in and a way to easily collect those eggs. Layers appreciate some outdoor space; if you have room for them to do a little roaming around the yard, your eggs will have darker yolks and you will need less feed.

Thinking about home-grown meat?

Don't expect to save lots of money raising your own chickens for meat unless you regularly pay a premium price for organic free-range chickens at the store. Most homeowners raising chickens for home use wind up paying as much per pound as they would buying chicken on sale at the local big-chain store. But that's not why you want to raise them.

You want to raise your own chickens because you can control what they eat and how they are treated. You want to take responsibility for the way some of your food is produced and take pride in knowing how to do it.

You need enough space to raise at least 10 to 25 birds to make meat production worthwhile. If you live in an urban area that allows only a few chickens, producing meat probably isn't for you.

Average people who have the space and enough time can successfully raise all the chicken they want to eat in a year. And with modern meat-type chickens, you can be eating fried homegrown chicken 10 weeks after you get the chicks — or even sooner.

Raising chickens to eat isn't going to be easy, especially at first. But it isn't so hard that you can't master it. For most people, the hardest part is the butchering, but the good news is that you can usually find folks who will do that job for you for a fee.

You can raise chickens that taste just like the chickens you buy in the store, but if you intend to raise free-range or pastured meat chickens, expect to get used to a new flavor. The meat has more muscle, or dark meat, and a different flavor. For most people, it's a *better* flavor, but it may take some getting used to.

Considering neighbors

Neighbors are any people who are in sight, sound, and smelling distance of your chickens. Even if it's legal in your urban or suburban area to keep chickens, the law may require your neighbors' approval and continued tolerance. And it pays to keep your neighbors happy anyway. If neighbors don't even know the chickens exist, they won't complain. If they know about them but get free eggs, they probably won't complain, either.

A constant battle with neighbors who don't like your chickens may lead to the municipality banning your chickens — or even banning everyone's chickens. Regardless of your situation, the following list gives you some ideas to keep you in your neighbors' good graces:

- **Try to hide housing or blend it into the landscape.** If you can disguise the chicken quarters in the garden or hide them behind the garage, so much the better. Don't locate your chickens close to the property line, if at all possible.
- **Keep your chicken housing neat and clean.** Your chicken shelter should be neat and immaculately clean.
- **Store or dispose of manure and other wastes properly.** Consider where you're going to store or dispose of manure and other waste. You can't use poultry manure in the garden without some time to age because it burns plants. It makes good compost, but a pile of pure chicken manure composting may offend some neighbors. You may need to bury waste or haul it away. Or if you're already composting in the garden like a good homesteader, consider adding your chicken manure to your pile. It may help mask the smell of the manure and enrich your overall mix. (Plenty more on composting in Book 1, Chapter 4.)
- **Even if roosters are legal, consider doing without them.** You may love the sound of a rooster greeting the day, but the noise can be annoying to some people. Roosters can and do crow at all times of the day — and even at night. Roosters aren't necessary for full egg production anyway; they're needed only for producing fertile eggs for hatching.
- **Keep your chicken population low.** If you have close neighbors, try to restrain your impulses to have more chickens than you really need. We suggest two hens for each family member for egg production. The more chickens you keep, the more likely you'll have objections to noise or smells.
- **Confine chickens to your property.** Foraging chickens can roam a good distance. Chickens can easily destroy a newly planted vegetable garden, uproot young perennials, and pick the blossoms off annuals. They can make walking barefoot across the lawn or patio a sticky situation. Mean roosters can scare or even harm small children and pets. And if your neighbor comes out one morning and finds your chickens roosting on the top of his new car, he's not going to be happy.

You can fence your property if you want to and if it's legal to do so, but remember that lightweight hens and bantams can easily fly up on and go over a 4-foot fence. Some heavier birds may also learn to hop the fence. Chickens are also great at wriggling through small holes if the grass looks greener on the other side.

- **Be aggressive about controlling pests.** In urban and suburban areas, you must have an aggressive plan to control pest animals such as rats and mice. If your chickens are seen as the source of these pests, neighbors may complain.
- **Share the chicken benefits.** Bring some eggs to your neighbors or allow their kids to feed the chickens. A gardening neighbor may like to have your manure and soiled bedding for compost. Just do what you can to make chickens seem like a mutually beneficial endeavor.
- **Never butcher a chicken in view of the neighbors.** Neighbors may go along with you having chickens as pets or for eggs, but they may have strong feelings about raising them for meat. If you butcher at home, you need a way to dispose of blood, feathers, and other waste. This waste smells and attracts flies and other pests. We strongly advise those of you who raise meat birds and have close neighbors to send your birds out to be butchered.

Finally, don't assume that because you and your neighbors are good friends, they won't care or complain about any chickens kept illegally.

Getting the right number

No matter how many chickens you intend to have eventually, if you're new to chicken-keeping, it pays to start off small. Get some experience caring for the birds and see whether you really want to have more. Even if you have some experience, you may want to go to larger numbers of birds in steps, making sure you have proper housing and enough time to care for the birds at each step.

Because chickens are social and don't do well alone, you need to start with at least two birds: two hens or a rooster and a hen. (Two roosters will fight!) Beyond two birds, the number of birds you choose to raise depends on your needs and situation:

- **Layers:** You can figure that one young hen of an egg-laying strain will lay about six eggs a week, two will lay a dozen eggs, and so on. If the birds aren't from an egg-laying strain but you still want eggs, count on three or four hens for a dozen eggs a week. So figure out how many hens you need based on how many eggs your family uses in a week — just don't forget to figure on more hens if you don't get them from an egg-laying strain.

- **Meat birds:** It really doesn't pay to raise just a few chickens for meat, but if your goal is to produce meat and space is limited, you can raise meat birds in batches of 10 to 25 birds, with each batch of broiler strains taking about six to nine weeks to grow to butchering size. If space and time to care for the birds aren't problems, determine how many chickens your family eats in a week and base your number of meat birds on that.

  If it takes six to nine weeks to raise chickens to butchering age and your family wants two chickens a week, you probably want to buy your meat chickens in batches of 25 and start another group as soon as you butcher the first. Or if you want a rest between batches, raise 50 to 60 meat chicks at a time and start the second batch about three months after the first. Remember that frozen chicken retains good quality for about 6 months.
- **Pet and show birds:** When you're acquiring chickens for pet and show purposes, you're limited only by your housing size and the time and resources you have to care for them. Full-size birds need about 2 square feet of shelter space per bird; bantam breeds need somewhat less. Don't overcrowd your housing.

  If you're going to breed chickens to preserve a breed or produce show stock, plan on at least two hens for each rooster, but not more than ten. In some large breeds with low fertility, you may need a ratio of five or six hens per rooster.

Chicken Breeds

A *chicken breed* is a group of chickens that look similar, have similar genetics, and, when bred together, produce more chickens similar to them. Breeds don't just emphasize visual differences, however. Like most domesticated animals, chickens have been selected over time for their capability to fit certain needs that humans have for them. Some chickens are better as meat birds, some are better at laying eggs, and some are just better looking.

To make choosing the breeds you want to raise easier, chickens are grouped into the following categories:

- **Dual-purpose breeds:** Dual-purpose breeds are the kind many people keep around the homestead. They lay reasonably well, are calm and friendly, and have enough meat on their bones that excess birds can be used for eating.
- **Egg layers:** The laying breeds won't sit on their own eggs. In the first year of production, they may lay 290 to 300 eggs and only slightly less for the next two years. They don't make good meat birds, although they can be eaten.

- **Meat breeds:** Meat birds were developed to have deeper, larger breasts, a larger frame, and fast growth. Most of the chickens we call meat breeds are hybrids, although some purebreds, such as the Cornish, are considered great meat birds. Meat-type birds generally don't lay well.
- **Show breeds:** Some chickens are kept for purely ornamental reasons. They generally don't lay a lot of eggs, although their eggs are certainly edible. Most ornamental-type birds don't make good meals, either, although any chicken can be eaten. These birds are kept for their beautiful colors or unusual feathers.
- **Bantam breeds:** Bantams are miniature versions of bigger chicken breeds or small chickens that never had a larger version. If there's no large version, they're called true bantams. These birds range from two to about five pounds.

If you want it all: dual-purpose breeds

Home flock owners often want chickens that will give them a decent amount of eggs and also be meaty enough so that they can use excess birds as meat birds. The eggs taste the same; you just don't get as many as you do from laying breeds. The meat tastes the same if you raise the dual-purpose birds like you raise meat birds, but their breasts are smaller and the birds grow much more slowly. Figure 3-1 illustrates common dual-purpose breeds, including these breeds:

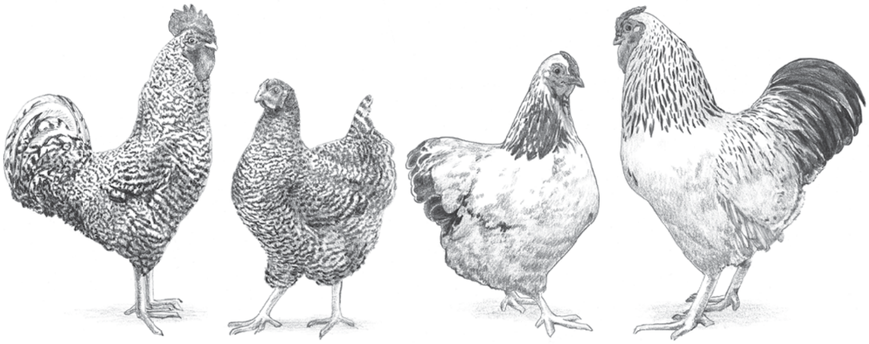


FIGURE 3-1: Common dual-purpose breeds — Barred Plymouth Rock (left) and Wyandotte (right).

- **Barnevelder:** The Barnevelder is an old breed that's making a comeback because of its dark brown eggs. Barnevelders are fair layers and are heavy enough to make a good meat bird, although they're slow growing. They come in black, white, and blue-laced, as well as other colors. These calm, docile birds are fluffy looking and soft feathered.
- **Brahma:** The Brahma is a large, fluffy-looking bird that lays brown eggs. Brahmas are good sitters and mothers and, as such, are often used to hatch

other breeds' eggs. They're good meat birds, but they mature slowly. Their feet are feathered, and they come in several colors and color combos. They withstand cold weather well, and they're calm and easy to handle.

- **Orpington:** Orpingtons deserve their popularity as a farm breed. They're large, meaty birds, and they're pretty good layers of brown eggs. They'll also sit on eggs and they're good mothers. Buff or golden-colored Orpingtons are the most popular, but they also come in blue, black, and white. These birds are calm and gentle. They can forage pretty well but don't mind confinement.
- **Plymouth Rocks:** These birds are an excellent old American breed, good for both eggs and meat. White Plymouth Rocks are used for hybrid meat crosses, but several other color varieties of the breed, including buff, blue, and the popular striped black-and-white birds called Barred Rocks, make good dual-purpose birds. They are pretty good layers of medium-size brown eggs, will sit on eggs, and are excellent home meat birds. They're usually calm, gentle birds, good for free-range or pastured production.
- **Wyandotte:** These large, fluffy-looking birds are excellent as farm flocks. They're pretty good layers of brown eggs (some will sit on eggs), and they make excellent meat birds. They come in several colors, with Silver Laced and Columbian being the most popular. Wyandottes are fairly quick to mature, compared to other dual-purpose breeds. Most are docile, friendly birds.
- **Turken/Transylvanian Naked Neck:** With an odd name like this, you may think this breed was crossed with a turkey — but it isn't. This breed comes in many colors, but the distinguishing feature is a lack of feathers on the neck. The genes that make the neck bare also contribute to a good-sized, meaty breast area in the chicken and make it easier to pluck. These birds are fairly good layers of medium to large light brown eggs. Although they may look ugly, Turkens are calm and friendly birds.

For egg lovers: laying breeds

If you want hens that lay a certain color of eggs, you can read breed descriptions or you can look at the color of the skin patch around the ear. Hens with white skin around the ear generally lay white eggs. Red skin around the ears generally means brown eggs, in any number of shades. (There's no way to tell what shade of brown from looking at the ear patch.) The breeds that lay greenish-blue eggs usually have red ear-skin patches.

REMEMBER

It's important to remember that all colors of eggs have the same nutritional qualities and taste.

White-egg layers

The white-egg layers in the following list (see Figure 3-2 for an illustration) are the most productive, although many others also exist. Although there are individual exceptions, white-egg layers tend to be more nervous and harder to tame than brown-egg layers. That may be why many home flocks consist of the latter. But if you want a lot of white eggs, the following birds are the best breeds to choose from:

- **White or Pearl Leghorn:** This bird accounts for at least 90 percent of the world's white-egg production. It's lightweight and has a large, red, single comb. Leghorns also come in other colors that don't lay as many eggs but are fine for home flocks. Leghorns tend to be nervous and don't do as well in free-range or pastured situations as other breeds. California Whites are a hybrid of Leghorns and a Barred breed that are quieter than Pearl Leghorns. Other hybrids are also available.

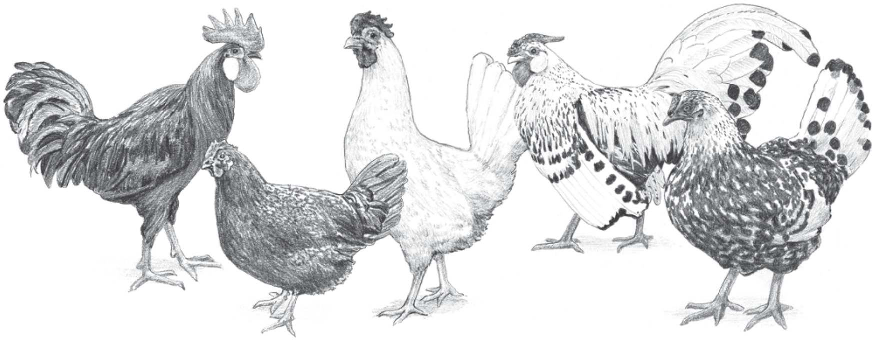


FIGURE 3-2: Common breeds that lay white eggs — Minorca (far left), white Leghorn (middle), and Hamburg (right).

Illustration by Barbara Frake

- **Ancona:** Anconas lay large white eggs. They're black feathered, and some feathers have a white tip that gives the bird a dotted appearance. They're similar in shape to the Leghorn. Anconas are flighty and wild acting. Originally from Italy, they're becoming rare and harder to find.
- **Andulusian:** The Andulusian chicken has enjoyed an upswing in popularity in recent years. Originally developed in Spain, the bird is known for its beautiful blue-gray shade; the edges of the feathers are outlined in a darker gray. These chickens are good layers of medium to large white eggs. They are lightweight birds and like to fly, which can be a problem when confining them. Andulusians are a purebred breed of chicken, but the blue color doesn't breed true: Offspring can be black or white with gray spots, called a splash. These colors are equally fine as layers — they just can't be shown.

- **Hamburg:** One of the oldest egg-laying breeds, Hamburgs are prolific layers of white eggs. They come in spangled and penciled gold or silver, or solid white or black. Hamburgs of all colors have slate-blue leg shanks and rose combs. They're active birds and good foragers, but they're not especially tame.
- **Minorca:** Minorcas are large birds that lay lots of large to extra-large white eggs. They come in black, white, or buff (golden) colors. Minorcas can have single or rose combs. They're active and good foragers, but they're not easy to tame. The Minorca is another bird that's becoming hard to find.

Brown-egg layers

For home flocks, brown-egg layers are popular (see Figure 3-3). The brown eggs these birds lay can vary from light tan to deep chocolate brown, sometimes even within the same breed. As hens get older, their eggs tend to be lighter in color.

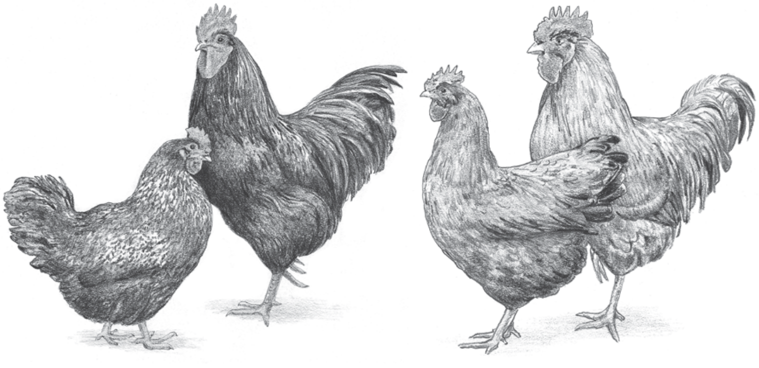


FIGURE 3-3: Common brown-egg layer breeds — Australorp (left) and Rhode Island Red (right).

Illustration by Barbara Frake

Some of the best brown-egg layers follow:

- **Isa Brown:** This hybrid makes up the world's largest population of brown-egg layers. Isa Browns are a genetically patented hybrid chicken. Only a few hatcheries can legally produce and sell the chicks, which means chicks hatched at someone's home or at a hatchery other than a licensed one aren't selling real Isa Browns. Isas are a combination of Rhode Island Red and Rhode Island White chickens — which are considered to be separate breeds, not colors — and possibly other breeds.

  Isa Brown hens are red-brown in color, with some white under-feathering and occasional white tail feathers; the roosters are white. The hens lay large to extra-large brown eggs that range in color from light to chocolate brown. These calm and gentle birds are easy to work with and are also good foragers.

They may be production birds, but they have great personalities and are people-friendly. The disadvantages are that they can't be kept for breeding (they don't breed true), and the roosters don't make good meat birds.

- **Amber Link:** This breed is a close relative to the Isa Brown, with a slightly darker brown egg that tends to be medium to large in size. Amber Links are white with some gold-brown feathers in the tail and wing area. They're productive and hardy, and are also calm, gentle birds. You'll probably be able to find them only at hatcheries that sell Isa Browns.
- **Red Star, Black Star, Cherry Egger, and Golden Comet:** All these are variations of the same breeding that produced Isa Browns. Some were developed from New Hampshires or other heavy breeds other than Rhode Island Reds. They're prolific layers of brown eggs, but they won't sit on eggs. They also don't make good meat birds because of their light frames. They're usually calm and friendly birds. If you're not going to breed birds and you just want good egg production, any of these chickens will fill the need.
- **Australorp:** A true breed rather than a hybrid, Australorps lay a lot of medium-size, light-brown eggs. Before Isa Browns, they were the brown-egg-laying champions. Both the hens and the roosters are solid black birds with single combs. They're calm, they mature early, and some will sit on eggs. They were developed in Australia from meat birds, and the roosters make moderately good eating.
- **New Hampshire Red:** New Hampshire Reds are similar to Rhode Island Reds, and the two are often confused with one another. True New Hampshire Reds are lighter red, they have black tail feathers and the neck feathers are lightly marked with black. They're more likely to brood eggs than Rhode Island Reds. New Hampshire Reds are usually calm and friendly but active. The breed has two strains: Some are good brown-egg layers, whereas others don't lay as well but are better meat birds.
- **Rhode Island Red:** Rhode Island Reds were developed in the United States from primarily meat birds, with an eye toward making them productive egg layers as well. They lay a lot of large brown eggs. Both sexes are a deep red-brown color and can have a single or rose comb. They're hardy, active birds that generally aren't too wild, but the roosters tend to be aggressive.
- **Rhode Island White:** Rhode Island Whites were developed from a slightly different background than Rhode Island Reds, which is why they're considered separate breeds and can be hybridized. They lay brown eggs. They birds are white with single or rose combs, and they're calm and hardy.
- **Maran:** These birds aren't recognized as a pure breed in all poultry associations. They are sometimes referred to as Cuckoo Marans — *cuckoo* refers to a color type (irregular bands of darker color on a lighter background). The breed has several color variations, including silver, golden, black, white, wheat, and

copper. Marans were once rare, but they're now popular for their very dark brown eggs. (Remember, though, eggs of different colors taste the same!) Not every Maran lays equally dark eggs. The eggs vary in size from medium to large. Most Marans are good layers, but they're not as good as some of the previously noted breeds. The various strains exhibit a lot of variation in the breed in terms of temperament and whether they will brood.

- **Welsummer:** Welsummers are also popular for their very dark brown eggs, which are medium to large in size. The hens are partridge colored (dark feathers with a gold edge), whereas the roosters are black with a red neck and red wing feathers. As members of an old, established breed, Welsummers are friendly, calm birds. They're good at foraging, and some will sit on eggs.

Colored-egg layers

Like the brown-egg layers, the colored-egg layers are also popular with home flock owners (Figure 3-4 illustrates two). Colored-egg layers are a novelty. Despite catalogs that show eggs in a rainbow of colors, their eggs are shades of blue and blue-green. Sometimes brown-egg layers whose eggs are a creamy light brown are said to lay yellow eggs. Pink, red, and purple eggs are said to exist, but these colors are generally caused by odd pigment mistakes and often aren't repeated. Some colors also are in the eye of the beholder (or the camera exposure), and what you call pink we may call light reddish-brown.

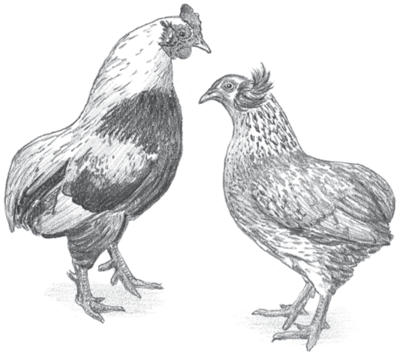


FIGURE 3-4: Common colored-egg layer breed — Araucana.

Looking to add some pops of color to your egg collection basket? Check out these chicken breeds:

- **Ameraucana:** The origin of the Ameraucana is debatable: Some say it developed from the Araucana (see the next bullet), whereas others say it developed from other South American breeds that lay blue eggs. Ameraucanas come in many colors. They have puffs of feathers or muffs at the side of the head, and some have beards. They have tails, which help distinguish them from Araucanas. Their temperament varies; however, many will sit on eggs. The eggs are blue or blue-green.

- **Araucana:** This breed of chicken is seldom seen in its purebred form. Many chickens sold as Araucana are actually mixes, so buyer beware. Purebred Araucanas have no tail feathers. They either have tuffs (small puffs of feathers at the ears) instead of large muff clumps or are clean faced. They don't have beards, and they have pea combs. Most have willow (gray-green) legs. The breed has many color variations. Araucanas lay small blue to blue-green eggs and are not terribly prolific layers. They're calm and make good brooders.
- **Easter Egger:** These birds are the mutts in the world of chickens because no one is quite sure of their background. They're usually a combination of the previous breeds and maybe some other South American blue-egg layers or other layers. They can be a bit more prolific in egg laying, but the egg color and temperament of the birds, as well as their adult body color, range greatly. They lay shades of blue, blue-green, and olive eggs.

Best breeds for the table

In the not-so-distant past, most meat chickens were young males that were the excess offspring from laying or show birds. They were kept just long enough to make a good meal — and that usually meant about five to six months of feeding and caring for the young roosters. The excess males in most heavy, generally brown-egg-laying breeds of chickens were used as meat. And in your great-grandparents' day, any hen that quit laying was also used for meat.

About 50 years ago, breeders began to create hybridized strains of chickens specifically for meat (see Figure 3-5). They grew fast and gained weight quickly on less feed than other chickens. They had more breast meat, something consumers seem to want. Over the years, these hybrids — particularly one hybrid, a cross between White Rocks and White Cornish breed chickens — have dominated the commercial meat market. In fact, almost every chicken you can buy in a grocery store is a strain of the previously mentioned cross.

Most meat birds stem from one hybrid, but home flock owners can consider other good meat breeds as well. Many backyard breeders are trying to develop meat breeds that grow quickly and have good meat yield, but are hardy and active enough to do well in pasture or free-range situations.

The meat of these other meat breeds may taste slightly different if the birds are raised on pasture and take longer to grow. The meat is a little firmer, and there's less breast meat. The taste is described by some as old-fashioned chicken flavor, which is hard to describe unless you've eaten both types. If the chickens eat commercial feed and aren't allowed to get too old before butchering, the older type meat birds taste much like hybrid meat birds. The advantage of hybrids is that they grow about twice as quickly and, on less feed, than conventional meat breeds.

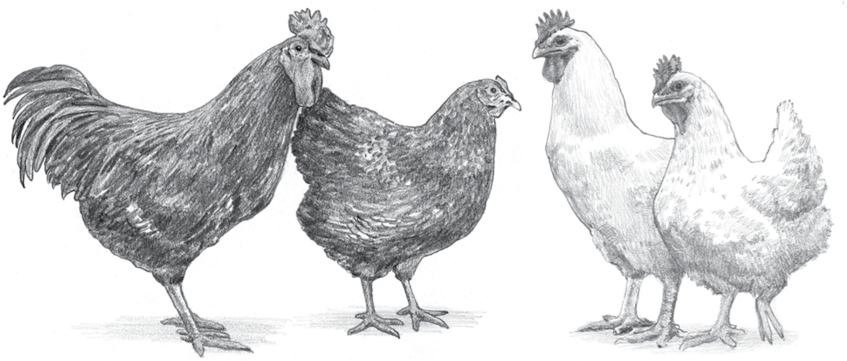


FIGURE 3-5: Common meat breeds — Jersey Giant (left) and Cornish X Rock (right).

If you're raising chickens for meat, here are some breeds to consider:

- **Cornish X Rock hybrids:** Almost all chickens sold for meat today are a hybrid of White Cornish and White Rock chickens. They've been tinkered with until we now have an extremely fast-growing bird with huge breasts. They're often ready to butcher at 10 weeks, and they do a remarkable job of converting feed into meat. They have soft, tender-textured, bland-flavored meat and lots of white breast meat. Both sexes make good eating and grow at nearly the same rate. If you have eaten only store-purchased chicken, you certainly know how they taste.

  Different strains exist, even some where feather color has been introduced. Basically, however, commercial meat birds are Cornish-Rock crosses. These birds have special nutritional needs and aren't good for free-range or pastured poultry. They're excellent if you want quick, plump meat birds, but they're not good for anything else.

  These breeds gave up some features to achieve these meat goals. They're closely related genetically, with three or so large firms controlling the production of parent stock. They have to be managed carefully and fed a high-protein diet to avoid problems with their legs and hearts. Basically, they're basketballs with feathers, they're inactive, and they spend most of their time eating. They can't reproduce normally.

- **Cornish:** The Cornish is an old breed known for its wide stance and big breasts. Several colors other than the white ones used to make meat hybrids exist, including red, buff, and laced patterns. They have a rose comb, and their feathers are tight and sleek. These birds are poor layers of small white eggs; some will brood. They can be aggressive with each other, but they're fairly tame with keepers. Cornish chickens are only fair foragers and are better raised in pens.

- **Jersey Giants:** This American breed comprises the world's largest chickens. They come in black or white. They're meaty birds, but they grow slowly. Jersey Giants are fairly good layers of medium-size brown eggs. They're calm, they're good at foraging, and they make good brooders.
- **Freedom Rangers/Red Rangers:** These birds were developed to be good pasture-fed meat birds, primarily for the organic meat market. They thrive on lower-protein feed and are better foragers than Cornish-Rock crosses. Most are red in color, with a few barred or black spotted feathers; gray and bronze colors are also seen. These birds take a few weeks longer than the Cornish-cross broilers to be ready to butcher, but many people think they taste better. They're also less likely to suffer from leg problems or die of heart failure than the Cornish-cross broilers. Rangers can be hard to find, and the breed still has a lot of variability: Some birds mature faster and have more meat than others.

Analyzing the Anatomy of a Coop

If you plan on keeping chickens, you'll need somewhere for them to live. A dedicated chicken coop is a must for anyone getting into the hobby, and something you'll need to figure out fairly early in the process. And it won't take much shopping around for you to realize that you will have a lot of options when it comes to housing your flock.

Whether you buy a pre-built coop or build your own housing (Book 5, Chapter 3 has detailed construction plans for a basic coop), you can go as simple or as fancy as you want.

Although the aesthetics may mean a great deal to you and your family as you embark on your coop-building adventure, the chickens, quite frankly, couldn't give a cluck. To your birds, a new chicken coop needs only to have a few select things going for it. Here's a quick list of what you need to consider before you start building a coop or settle on a specific design.

Providing the basics

Whether the coop you have pictured in your mind is a basic box cobbled together from some scrap wood or an enormous architectural masterpiece with its own ZIP code, a coop must provide the following:

- **Shelter:** Even wild chickens take cover when the weather turns nasty. If you're going to keep chickens in your suburban backyard, you have to give them a place where they can find shelter from rain, wind, heat, and cold.

- **Protection:** Humans aren't the only carnivores who enjoy a finger-lickin' good chicken dinner every now and again. A primary requirement of any coop is that it effectively offers protection from predators.
- **Space:** Regardless of your property's space constraints, here's a golden rule to always keep in mind: Your coop should provide 2 to 4 square feet of floor space for each bird you keep.
- **Lighting:** Chickens need around 14 hours of sunlight every day. They aren't always able to get all of it outdoors. Whether it's via a window, a door, or a skylight, your coop needs to allow some light inside.
- **Ventilation:** Chickens poop. Often. Wherever they happen to be when nature calls. The coop will get stinky. You can't prevent that, but you must exhaust that ammonia-saturated air for the health of you and your birds.
- **Cleanliness:** Once again, chickens poop. The coop will get messy. You need to think through how you, their caretaker, will take care of that dirty job on a regular basis.

REMEMBER

Just because a neighbor in your area has chickens or a mighty fine backyard coop or both does *not* automatically mean that everything is cool for you to do the same. His property's zoning may be different from yours. He may have started raising chickens before some change in local laws or the advent of the neighborhood's covenants. He may have gone through proper channels to obtain a zoning variance. Or it may just be that he's in violation of the law himself and keeping chickens illegally.

Do your homework and know what's acceptable before investing your time, effort, and money in a backyard flock or a built-from-scratch chicken coop. Be sure to check with local government officials about zoning restrictions and whether building permits are needed for constructing a coop on your property. This may mean a trip to your city or township hall, the community planning board, the county clerk's office, or even animal control! And even if *they* all give you the green light, make sure your neighborhood or subdivision doesn't have a rule against a backyard chicken coop.

Figuring out features

Even though coops come in a myriad of shapes and sizes, with special amenities and added quirks as varied as the chicken-owners who build them, there are a few basic features that every chicken shelter should have. Think of the following items as furniture for your coop, the physical things that take an empty structure and turn it into a chicken's home:

- **Roosts:** A *roost* is where your chicken will sleep. True free-range chickens in the wild find a tree branch to perch on each night to sleep. This offers them protection from non-climbing predators, and a branch under the canopy of a tree can provide cover from hungry owls and nasty weather. In your coop, a horizontally-oriented pole or board that's elevated off the floor serves the same function, as seen in Figure 3-6.

  REMEMBER

  Aim for giving each bird at least 12 inches of roost. Your roost (or roosts) should be as high as possible inside the coop while still allowing your chickens to sit fully upright on it. (But because chickens aren't big flyers, they may need some help reaching the roost, especially as they get older. A ramp or series of horizontal "steps" to the roost bar can be used as needed.) Also, realize that the area directly under the roost will collect the greatest concentration of droppings, so plan accordingly.

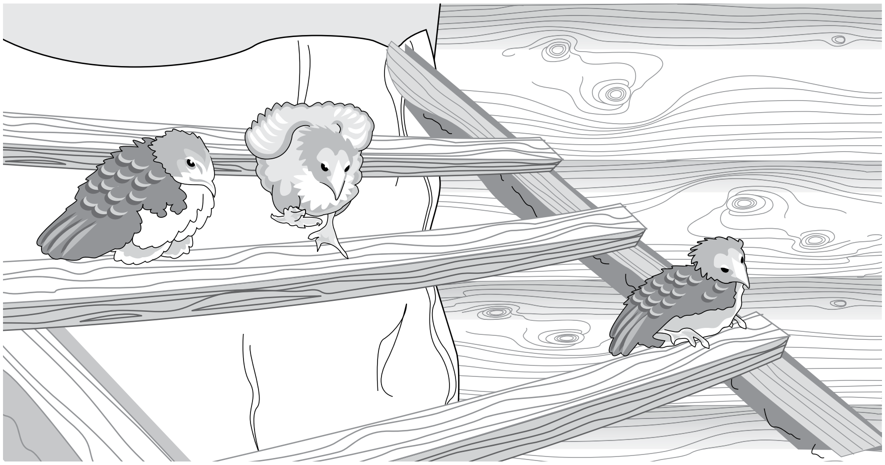


FIGURE 3-6: A simple roost is a chicken's master bedroom.

- **Nest boxes:** If you're keeping chickens for their eggs, nest boxes are a necessity (even though many owners of particularly-finicky chickens will tell you that their nest boxes go unused more often than not). A *nest box* (see Figure 3-7) is exactly that: a safe, comfortable, and secluded spot where your hens can lay their eggs.

  REMEMBER

  - Hens will share nest boxes, so having one nest box for every two (or even three) birds is sufficient.
  - Each box should be a minimum of 12 inches square, or big enough so a chicken can comfortably walk in, turn around in a circle, and then stand fully upright when she's done laying.

- A nest box should be in a dimly lit and warm area of the coop, no more than 3 or 4 feet off the floor.
- If you have more than one box, bunch them together to allow the birds to socialize with one another as they do their business.

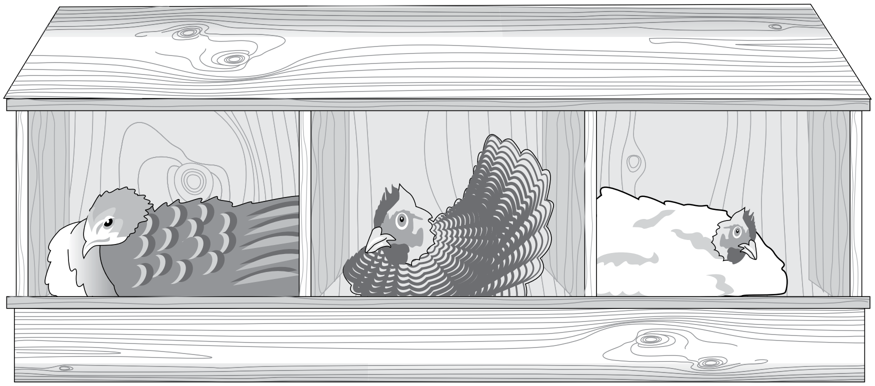


FIGURE 3-7: Nest boxes are critical if you're encouraging egg production from your flock.

- **Runs:** A *run* is the yard for your chicken coop, giving your flock access to fresh air and sunshine. It's an open-air space, usually wrapped in some sort of fencing material and may even be fully covered by a roof. A run should allow each bird to have 3 to 6 square feet, but more is better. For most backyard chicken owners, a coop that incorporates the run into one structure is generally easiest to build and maintain, but folks with enough land may prefer to have a large fenced run that encompasses the chickens' shelter, or even allow the birds to roam free-range with no fencing at all.
- **Ramps:** Chickens are birds, but that doesn't mean they soar through the air like eagles. Many coops are built with a sizable (for a chicken) drop from the shelter down to the ground. Your chickens will be much happier if they don't have to flutter and flop their way in and out of the coop on a regular basis. Look at constructing a simple ramp that lets your flock strut up and down in style. It usually requires no more than a few pieces of scrap wood, but it'll make all the difference in the world to your birds.

Building your own chicken coop is a great way to save some money and a low-pressure way to work on your carpentry skills. No matter your tool prowess, your flock will be forgiving when it comes to the craftsmanship of their coop, and you'll be just a little more self-sufficient for having done it yourself. Check out Book 5, Chapter 3 for step-by-step instructions for a basic coop that checks all the boxes.

IN THIS CHAPTER

- Caring for and feeding your flock
- Raising baby chicks from hatchlings
- Harvesting your chickens' eggs

Chapter 4

Raising Your Chicken Flock

So you've decided to get chickens. Now what? Bringing your birds home and introducing them to your yard is just the beginning of this new adventure. And making your flock an integral contributing part of your backyard homestead? Well, that will require a little bit of effort on your part.

This chapter covers feeding your chickens, explains the ins and outs of raising baby chicks, lays out the threats presented by pests and predators, and cracks open what you need to know about the reason why you're considering chickens in the first places: eggs. All the information in this chapter will help ensure that you're not just — ahem — "winging it" when it comes to raising chickens.

Feeding Your Flock

Probably more controversy swirls over feeding chickens than any other part of chicken raising — *everybody* has an opinion. Some believe you don't need to feed chickens at all; just turn the birds loose to find their own feed. Others devise elaborate diets that chickens love but that really aren't necessary. Chickens aren't fussy eaters; they'll eat just about anything. However, they're like small children: When faced with an abundance of choices, they don't always make the wise ones.

Chickens aren't vegetarians by nature. They're *omnivorous*, meaning that they eat both animal protein and plant-produced foods such as seeds, fruits, and leaves. Wild chickens get their protein in two ways:

- **They actively hunt for it.** They chase butterflies and grasshoppers and gobble up tiny frogs and baby mice.
- **They scavenge it.** They have no qualms about picking apart a dead carcass, including the body of another chicken.

In a domesticated setting, chickens still love to roam the grounds looking for food, but the places we choose to keep them don't always support their nutritional needs. Most chickens need to be fed by you, the chicken-keeper.

Nutritional needs

Chickens need 16 to 24 percent protein in their diet, depending on their age and intended use. Laying hens need good-quality protein in their diet to produce quality eggs for long periods of time. If broiler-type birds don't get enough protein, their legs and wings may become deformed, and they may become unable to walk. They then need to be disposed of because they won't eat well.

Chickens don't require a lot of fat. High-energy broiler feeds need 6 to 7 percent fat, and laying feed and chick starter need about 3.5 to 4 percent fat. Hens do need some fat for the production of egg yolk, but carbohydrates should furnish the bulk of the diet, and a commercial diet based on grain easily supplies them. Carbs are burned in the bodies of all animals as fuel for all life processes, such as breathing and growth. Diets based on pasture or vegetation need grain supplements to provide enough carbohydrates.

Chickens require all the vitamins and minerals we do except vitamin C, which their bodies can make. Chickens get these vitamins and minerals from a properly formulated feed. Some types of chickens may need more of some nutrients. Layers, for example, need more calcium than other birds to continue laying well. This variation is why having the expertise of chicken nutrition specialists to formulate rations is so valuable.

WARNING

Some people have an abundance of homegrown grain or other products available to them and want to use those ingredients and their own recipe to supply to a feed mill. Despite what most people assume, the homemade recipe approach has more drawbacks than positives. For starters, homemade feed *isn't* cheaper than store-bought. Moreover, making your own recipes requires a complex understanding of chicken nutrition. And beyond those two negatives, most mills won't even custom-mix less than 1,000 pounds of feed.

Choosing the right commercial feed

As with other animals' feeds, chicken feed runs the gamut from top-quality name-brand feeds to poor-quality cheap feed. If a feed is labeled "complete and balanced," it must contain the recommended amounts of nutrients set by the National Research Council for poultry of the listed type and age.

When choosing commercial feed, first look for feed that suits your chickens' age and type, such as meat bird starter, layer, or all adult poultry. Most feed stores also sell a general-purpose poultry feed that you can give to birds not intended to be meat birds or layers, as well as a few specialized feeds.

Starter rations (for chicks)

The ration for layer-breed chicks should be 20 percent protein. It's usually just called "starter feed." From the time they start eating, meat chicks need a high-protein feed of about 22 to 24 percent protein for the first six weeks. It's called "meat bird starter" or "broiler starter."

If you've just received some baby chicks that you intend to be laying hens in the future, look for "chick starter." Buy the same feed for pet or show birds. But if you have meat-type chicks, buy "meat bird or broiler starter."

TIP

If you have different types of birds in a brooder, it's better to feed the higher-protein meat bird feed to all the chicks than use a lower-protein feed. However, separating your future layers from meat birds when they leave the brooder is strongly recommended. Meat birds need a protein level of about 22 to 24 percent until they're butchered, which is too high for layers.

Layer rations

When chickens that are being raised to be laying hens leave the brooder, or at six weeks, you need to change from a starter ration to the next level of feed. Taking care to feed young laying chickens correctly results in healthy birds that give you optimum egg production. Because they're around longer than meat birds, you should take an additional feeding step when raising them from chicks.

Here are the types of rations you should use:

- **Grower pullet ration:** The ration for growing pullets, from leaving the brooder at 6 weeks to about 14 weeks, should be about 18 percent protein. You want them to grow slowly enough to develop good strong bones and to reach a normal body weight before they begin producing eggs. High-protein diets tend to hurry the birds into production before their bodies are ready.

Finding a feed labelled "grower" with this level of protein may be hard. If you can't find the 18 percent grower feed, use the 16 percent finishing ration listed in the next bullet. These feeds are usually called "grower-finisher" feeds.

- **"Developer or finishing" pullet ration:** From 15 weeks to 22 weeks, it's ideal to lower the protein level of the feed to 16 percent. The object is to get pullets well grown without too much fat.

  Your feed should have normal levels of calcium and other vitamins until the birds start laying. Feeding an adult layer diet high in calcium and phosphorus to birds that aren't laying yet can damage their kidneys. If young hens start laying early, switch them right over to a laying ration.

- **Adult layer rations:** After the hens reach the age of 22 weeks or begin laying, and throughout their laying careers, they need a protein level of 16 to 18 percent. The calcium and minerals should be formulated for laying hens. A rooster housed with a laying flock will be fine consuming laying rations. These feeds are appropriately called "layer feed."

  WARNING

  Don't force extra calcium and minerals on hens by adding things to a properly formulated feed. Too much calcium can cause kidney failure. If you're getting a lot of thin eggshells or soft-shelled eggs, give your hens some calcium in the form of crushed oyster shells in a feeder where they can choose the amount.

Broiler rations

Home flock owners may encounter two types of meat birds: the Cornish X Rock crosses that grow extremely quickly and require precise diets, and the excess males from heavy breeds of chickens, which require slightly different management. Here are the details:

- **Cornish X Rock broiler hybrids:** After the first six weeks, you can lower the protein percentage for these birds to 18 to 20 percent until they're butchered. "Meat bird" or "broiler grower-finisher" is generally used on the label for these feeds aimed at meat birds in their last weeks. Many people feed starter rations for broilers right up to butchering — that strategy is fine, although grower rations are generally cheaper. (Check the label, if the starter feed is medicated, to see if you need to stop feeding that brand a few days before butchering.) A slightly lower protein percentage in the last few weeks of these broiler hybrids' lives may keep them from sudden death syndrome, a condition in which rapidly growing birds flip over on their backs and die, and prevent them from getting weak legs.
- **Heritage birds, dual-purpose males, and free-range meat birds:** These types of meat birds grow more slowly and add less muscle meat than the

broiler hybrids. They take longer to reach a satisfactory butchering rate. After the first six weeks, you can lower the protein to 18 to 20 percent for the next six weeks; after that, protein content can be 16 percent.

Whole-grain mixtures or scratch feed

Chickens do love whole-grain mixes, but they're almost impossible to accurately mix to provide all the nutrients a chicken needs. Many cheaper mixes are filled with pieces of corn cob and seeds that chickens don't seem to care for, such as milo. Scratch and whole-grain mixtures are best used to supplement the diets of chickens that have good free-range or pasture conditions or to relieve boredom in confined birds.

Selecting a form of feed

Most chicken feed is ground, mixed, cooked, or steam-treated and then turned into mash, crumbles, or pellets. When products are mixed and bound together, each piece contains a balanced proportion of the mix. The vitamins and minerals don't sift out to the bottom, and chickens aren't able to pick out favorite pieces and waste others.

Feed comes in three forms:

- **Crumbles:** In research done on feeding chickens, the birds seemed to prefer medium-size pieces of feed, commonly known as *crumbles,* and they seemed to grow better and lay eggs better on this type of feed. Crumbles are broken-up pellets. Finisher rations for pullets or meat birds are commonly crumbles, but adult feeds also can be crumbles.
- **Pellets:** Pellets are the second-best method of feeding and the second most popular form of feed with chickens. *Pellets* are long, narrow, cylinder-shaped pieces of compressed feed. They're usually used for adult birds.
- **Mash:** Mash is the least preferred form of feed. *Mash* is finely ground feed; the texture is like cornmeal. Starter feeds for chicks are usually mash texture and are best for small chicks.

  If mash is the only type of feed available to you for older chickens, you can add a little warm water to the feed just before serving it, which gives it the consistency of thick oatmeal. Water from cooking potatoes or other vegetables or milk also can be used. Serving mash is a good way to use up the fine pieces of crumbles or pellets left in the bottom of a bag or the feed dish. However, don't let this wet mixture sit too long because it will spoil and become moldy, which may harm the chickens.

Supplementing diets with grit

Because they have no teeth, chickens need grit in their *gizzard*, a muscular pouch that's part of the digestive system, to help break down food particles. In nature, chickens pick up small rocks, pieces of bone, and shells and store them in the gizzard to help digest food.

If you're feeding any kind of homemade diet, if you're giving whole grains, or if you have your birds on pasture, you need to supply them with some kind of grit. If you're feeding only a commercial mash, crumble, or pellet, your chickens won't require additional grit because these feeds are already quite easy for chickens to digest. Birds that range freely part of the day will pick up enough grit. However, some chicken owners feel that chickens are happier when they have grit — even if they don't need it because of the diet they're on.

You can purchase grit in feed stores. It consists of crushed limestone and granite. Different sizes are available for chicks and adult birds. If you have just a few chickens, you can purchase canary or parakeet grit in pet stores. It's finely ground but is fine for chicks or, in a pinch, for older birds.

Deciding when to put out feed

Most people fill their chickens' feed dishes so food is available much of the day, or they use feeders that hold several days' worth of feed. You can use this feeding method for all types of chickens. It's the way chickens eat in nature; they eat small amounts frequently.

Other folks still feed their chickens at certain times of the day, generally morning and evening. That way, they can control the amount of feed that may attract pests. And if the chickens are too heavy, it restricts the amount they can eat. Usually, however, it's just a matter of preference; some people like to observe and tend to their chickens more often than others. This method works well for all but meat birds.

Chickens that are given free range may be more inclined to come to the coop to lay if they're fed there in the early morning. And if you need to lock the chickens up every night to protect them from predators, feeding them in the coop in the evening entices them there.

Because of their heavy rate of growth, the meat-type broiler chickens need to have food available to them for longer periods of time. Remember, chickens don't eat in the dark, so the lights must be on for them to eat. For the Rock-Cornish crosses, the lights need to be on 18 to 22 hours a day, and feed should be in the feed pans for those hours.

Determining how much to feed

Determining how much feed your chickens are going to eat per day or week is difficult because so many variables are involved. The type of chickens, whether they're growing or laying, and how active they are, affect the amount of feed each bird needs. How neat you are, the type of feeders you have, and the number of free-loading pests you support also change the amount of feed you need. The weather is a factor, too: Chickens eat more in cold weather and less in hot weather.

Our modern, high-production egg breeds convert feed to eggs very efficiently, especially if they're fed a ration formulated for laying hens. After they're laying well, it takes about 4 pounds of a quality feed of 16 to 18 percent protein to produce a dozen eggs. The breeds kept for dual purposes (eggs and meat) generally have heavier body masses to support and need more feed to produce a dozen eggs than a lighter-production breed.

About 2 pounds of feed are needed to produce 1 pound of body weight on a growing meat-type bird. So if a broiler weighs about 6 pounds at 10 weeks, it will have eaten about 12 pounds of feed. Remember that it ate less when it was small, and the amount of feed consumed increased each week. A medium-weight laying hen will eat about ¼ pound of feed per day when she begins producing. These figures are rough estimates, but they give you some idea of what to expect.

REMEMBER

When you pick up your birds, they should feel well fleshed but without rolls of fat. If the breastbone feels very sharp and prominent, they're probably too thin. Chickens that don't get enough feed will stop laying. The thinner birds in the flock and the ones in which vitamin and mineral deficiencies show up first are the ones that are lowest in the pecking order; dominant birds tend to eat first and eat the best of what's available.

Hydrating your hens (and roosters)

Having a source of clean water is vitally important to your chickens. Chickens whose water intake is restricted don't eat as well as chickens with unrestricted access, and they don't grow as fast or lay as well, either. People often don't realize how important water is to their chickens until they go from pouring water in a dish once a day to a system that allows birds to always have fresh water available. The birds with unrestricted access to clean water grow better, are healthier, and lay more eggs.

In moderate weather, a hen may drink a pint of water a day. In hot weather, that amount nearly doubles. Broilers may drink even more as their metabolism works much harder, producing more heat and using more water. Birds roaming freely may drink more or less than confined birds, depending on the moisture content of the food they consume and how active they are.

In hot weather, providing an unlimited quantity of cool, clean water may mean the difference between life and death for your birds. In winter, if temps are below freezing, offer water at least twice a day in sufficient quantity that all birds can drink until they're full. Alternately, use a heated water container.

WARNING

Any time birds stop eating as much as usual, check the water supply. Be sure to manually check nipple systems frequently to make sure they're working. There are plenty of horror stories of nipple valve systems becoming clogged by mineral deposits or other materials and failing to work. These devices freeze up easily in cold weather, too. If the chicken caretaker fails to notice that the chickens can't get water, the birds die of thirst.

Raising Baby Chicks

Many people start with chicks because they fall in love with some at the farm store or someone gives their kids chicks for Easter. Beginning your chicken-raising experience with baby chicks is probably the most economical and practical way to start, for the following reasons:

- You can choose from a wide assortment of breeds.
- Chicks are less likely to carry disease and parasites than older birds, especially if you buy them from a well-run hatchery.
- You don't have to guess how old the birds are.
- Most hatcheries will sex the chicks for you, so you don't have to guess at sex.
- Chicks usually cost less than older birds.

Many mail-order hatcheries operate across the United States. You can order chicks by catalog or from online sites. Some have dozens of breeds available; others specialize in one or two breeds. Baby chicks survive the trip through the mail pretty well.

TIP

When you mail-order baby chicks, you're usually required to order at least a minimum number of chicks. Usually this is 25 chicks, which may be 20 more chicks than you need or want. If you live near a hatchery and can pick up the chicks, you may be able to purchase fewer. You may also have local chicken breeders in your area who will sell you just a few chicks. The local feed store may also sell chicks, or at least be able to tell you who does.

Chicks are cute, but for many people, they may not be the best way to begin keeping chickens. Baby chicks do have their drawbacks:

- **They need TLC.** All baby animals take extra time and effort to care for.
- **They're fragile.** Small children and pets can easily damage or kill them.
- **They require special brooding equipment.** They need to be kept warm and protected.
- **Their quality is hard to judge.** Judging the quality of a chick is difficult, so if you want to show chickens, you need to keep a lot of chicks until they're adults so you can then pick the best of the bunch.
- **They need time to mature.** If you want chickens for eggs, know that pullet (female) chicks need at least five months to mature and begin to lay eggs. Some breeds need several months longer.
- **Their sex is hard to determine.** Although hatcheries can do a pretty good job of sexing chicks, you may not end up with as many hens as you expect, and then you'll have extra roosters to deal with, too. If you buy your chicks from a private breeder, his or her skills at sexing chicks may be poor, and you may not get any hens at all.
- **They need extra protection.** If you just want chickens for living lawn ornaments, it's going to be several months before they can be allowed to roam safely. You may want to consider adult birds if you're the impatient type.

The basics of brooders

Baby chicks need to be kept quite warm their first few weeks of life. Without the proper warmth, they won't eat or drink and will soon die. In natural conditions, they snuggle under their mama's breast and belly.

Chicks raised without their mama need a source of warmth, too, and that's where you come in. Unless you have the money and means to heat an entire room to 95 degrees Fahrenheit, you need to provide a brooder for your chicks. A *brooder* is an enclosed area that allows chicks to find that perfect warm spot but also gives them a little space where the air is cooler. A brooder also protects the chicks in the absence of a mother hen.

Many types of brooders are on the market. Most use a heat lamp, but some use gas or propane to heat the unit. Alternatively, you can make your own brooder. Fashioning one from materials found around the home or from local stores is relatively easy to do.

Knowing when chicks need a brooder

Chicks need to go right from an incubator to a brooder. If you're getting your chicks from another source, put them into the brooder as soon as you get them. Set up the brooder a few days in advance of putting chicks in it so you can see how it operates and adjust the temperature as necessary to keep it around 95 degrees Fahrenheit.

Your chicks need a brooder for at least a month, depending on the weather and where they're housed. If you're raising chicks at a very cold time of the year, they may need to be kept warm even longer, especially at night.

If the weather is very hot (above 90 degrees Fahrenheit), take special care to see that the brooder doesn't get above 100 degrees. Older chicks may be uncomfortable at temperatures above 90 degrees, especially if the humidity is high. In this case, you need to provide some ventilation or other cooling to lower the temperature. The chicks may still need the brooder to confine them and keep them safe, however.

Choosing the brooder size and shape

Average-size chicks need about 36 square inches per chick for the first month. This space looks like a lot of room at first, but chicks grow rapidly, and it won't look like too much room when they're a month old. Some brooders are designed to be expandable so they can grow as the chicks grow.

Brooders need to be at least 18 inches deep, especially if the source of heat is overhead, as is the case with heat lamps. If your brooder uses heat lamps, be sure to adjust them upward as the chicks grow so their heads can't touch them. A deeper brooder can help prevent older chicks from jumping out, and the brooder should have some sort of cover to prevent the chicks from escaping.

Chicks need to be able to move from an area of optimal warmth to a cooler area within the brooder, if possible, so they can find just the right temperature that makes them comfortable. Rectangular brooders allow the heat source to be at one end, with progressively cooler temperatures toward the opposite end of the brooder. With square or round brooders, the heat source needs to be in the center.

Getting the temperature just right

For the first week, baby chicks need a temperature of 95 degrees Fahrenheit. Measure the temperature at the height of a chick's back, about 2 inches or so from the floor. Every week, lower the temperature by 5 degrees until you reach about 70 degrees. If temperatures fall below 50 degrees at night, you may want to turn on the heat at night for a few more weeks.

After you gain a little experience, you won't need a thermometer to tell you whether the temperature in a brooder is right. The actions and sounds of the chicks will let you know if it's too hot or cold. Watch the chicks for a few minutes with these tips in mind:

- If the chicks are casually and quietly walking around, eating and drinking, and some of them are peacefully snoozing near the heat source, the temperature is probably fine.
- If the chicks are huddled in a pile near the heat source or in a corner of a propane or gas unit, cheeping shrilly, they're cold. Cold chicks also eat less and are less active.
- If the chicks are spread along the edges of the brooder far from the heat source and have their beaks open, panting, they're too warm. Hot chicks drink more, eat less, and aren't very active.

Choosing brooder bedding

Chicks need some bedding in the brooder to absorb moisture, dry droppings, and reduce odor. You can use many materials for bedding, but pine shavings are easy to find and seem to be the best choice for many people. Clean sand and coarse sawdust are other good options.

Don't use paper (newspaper or any other kind), cardboard, or plastic on the bottom of brooders. These materials get slippery when wet, and the chicks can develop *spraddle legs*, which can lead to permanent disfigurement. Other materials not to use include kitty litter (which is often treated with dyes and scents and may swell if ingested), soil, vermiculite, perlite, cedar shavings (which sometimes irritate eyes and lungs), cotton batting, hay, leaves, and straw.

Hay, leaves, and straw, in particular, may contain harmful substances, may get slippery and moldy when wet, and aren't absorbent. Also avoid shavings made from unknown wood or from hardwoods. When moist and warm, hardwood shavings can develop a harmful mold. Anytime you notice mold on bedding, remove the bedding at once.

How often you need to change the bedding in a brooder varies with the type of litter, the age and number of chicks, the type of brooder, and many other factors. In general, if the bedding is damp and smelly, you need to change it completely. If it appears dry and fluffy but dirty, just add a fresh layer on top. After a while, the litter gets either wet or too deep for the brooder and needs to be changed.

You usually need to remove the chicks to change the litter. Place them in a large box where they'll be safe as you work. Unless it's really cold, they'll be warm enough for a short time without a heat source. If you wash the brooder with disinfectants or strong soaps, make sure you rinse the brooder well and dry it before adding bedding and chicks.

Always scrub a brooder between batches of chicks. Use a good disinfectant, such as common bleach (1 part bleach to 4 parts water), rinse it well, and let it air dry.

Helping a hen provide warmth and protection

If mother hen is present when the chicks hatch, she'll take care of their warmth. She needs just a little help from you to protect the chicks. If they're penned up, you need to separate the mom and her chicks from other chickens. In a coop, make sure the babies aren't able to get out and be harmed by other chickens. Roosters seldom bother chicks, but not all hens are motherly types, and they may hurt chicks.

In a free-range situation, if a hen hides and hatches eggs somewhere, the other chickens probably won't bother her — but her babies will be at risk from predators. Mama hen will try to protect them, but often she's no match for sneaky or overpowering predators. Mother hens may also steal babies from other hens if the babies are about the same age. A hen does have a limit to how many she can care for, and if chicks end up with surrogate moms, you may never know who's related to whom.

To save as many chicks as possible, enclose mama hen and chicks in a cage or pen that the chicks can't squeeze out of, at least until the chicks are about half grown and well feathered — about three months old. If the chicks do manage to get out and the mom can't, she has no way to protect them.

In pens or cages where baby chicks are present, make sure the chicks can reach water, but also ensure that the dish is too shallow for them to drown in. Chicks need finely ground starter feed instead of adult feed. The water and feed issues are another reason why separating chicks from older birds is a good idea. If they're free-ranging, they may find enough to eat in nature, but it doesn't hurt to offer some chick feed in a shallow dish.

Feeding and watering chicks

REMEMBER

Baby chicks don't *need* to eat or drink right away. The remains of the egg yolk in their abdomen will sustain them for a couple days — that's how they can be shipped in the mail to you. However, if you hatch them at home or get them soon after hatching from a local source, it's a good idea to offer feed and water as soon as the fluff has dried and the chicks are moving around.

Nature built in a little time before the chicks have to be fed, to give other eggs more time to hatch. In nature, a few chicks often hatch before the rest. The hen stays on the nest waiting for more eggs to hatch, and the hatched chicks usually stay under her. After a day or so, the hen leaves the eggs that didn't hatch and leads her young ones out to forage.

Feeding facts

Baby chicks need chick starter feed, which is available at farm and pet stores. It's formulated for them and sized right for tiny beaks. Adult chicken feed, feed for other animals, bread crumbs, and so on may keep chicks alive, but they won't grow well with these types of food.

Chicks grow fast. The broiler-type chicks especially need a high-protein starter feed, or they'll quickly start having problems with their legs. The feed is labeled as "broiler feed" or "meat bird feed." You can also use game-bird starter feed. Whatever you use, make sure the protein level is a minimum of 22 percent. If chicks don't get enough protein to sustain their rapid growth, their legs can become weak and twisted, and their wings may also grow distorted.

If you have only pet and layer-type chicks, you can use regular chick starter feed. When you have a mixture of meat and layer birds, use meat bird starter. It doesn't hurt the others, although you want to switch the layer chicks to a lower-protein feed when you separate them and move them from the brooder around five weeks. Regular starter feed needs a protein level of 20 percent.

Another choice to consider is whether to buy medicated or unmedicated feed. To get baby chicks off to a good start, medicated feeds include antibiotics and medications to control parasites and bacterial diseases. We strongly recommend medicated feed for the first month of a chick's life, especially if you don't vaccinate chicks. But we also know some chicken-keepers worry about raising animals on antibiotics and other medications. If you choose to use unmedicated feed you may lose more baby chicks and your chicks may not grow as well as those on medicated feeds, but it's a personal choice.

Place the feed in fairly shallow containers or dishes at first. Use dishes that are long and narrow or that have a slotted cover to prevent chicks from walking in the feed or scratching it out. As chicks grow, so must their feed containers. Have several feed containers or one large enough that all the chicks can eat at one time. You may need to add feeders in addition to switching to bigger ones as chicks grow. Many chick feeders and water containers are colored red, which is thought to attract chicks, but they'll learn to eat and drink from containers of any color. Figure 4-1 shows some common feed and water containers.

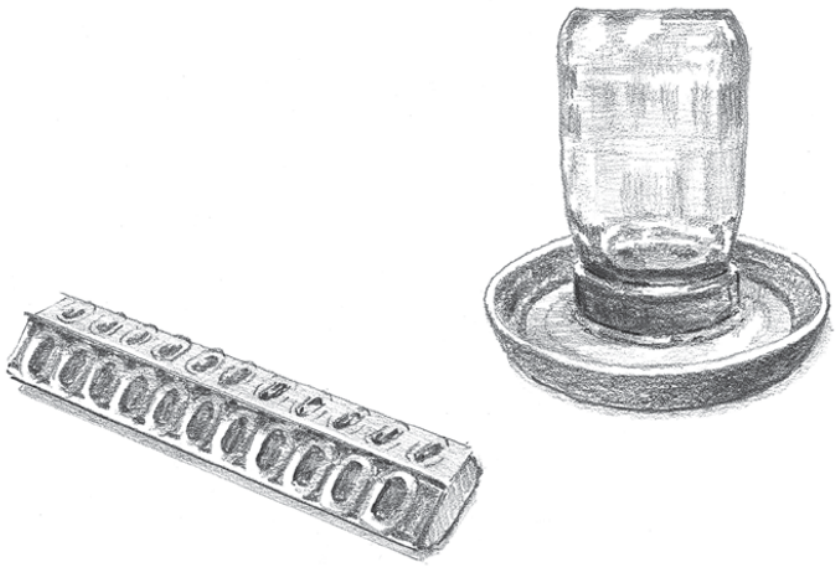


FIGURE 4-1: Examples of typical chick feed and water containers.

Illustration by Barbara Frake

Meat-type chicks need to have feed before them for at least 16 hours a day. But a few hours without feed, usually achieved by darkening the brooder so they can't eat, makes the broiler chicks grow a bit more slowly, which makes them healthier. For other chicks, a dish that's empty for a few hours is okay, as is feed available all the time. But if your chicks act ravenous and swarm the feeder when you add feed, you're not giving them enough.

Wondering about watering

Always have water available for your chicks. A special waterer for baby chicks with a shallow, narrow opening is best. You can buy inexpensive rings that screw onto a wide-mouth jar or purchase larger, more elaborate water holders.

WARNING

Baby chicks will drown in deep water containers, so don't use anything more than a couple inches deep.

If you use open containers, such as saucers, lids, and so on, add marbles or small stones so that there's little open surface. You want to prevent chicks from walking through water or perching on top of water containers. Keep the watering station clean. The area around the dish generally becomes wet and messy, and water dishes often get shavings or other bedding kicked into them. Scrub out any algae or scum that develops in containers. Then disinfect with a bleach solution of nine parts water and one part bleach, and then dry. If you want to inhibit mold growth without harming the chicks, use four to six drops of unscented household bleach per gallon of drinking water.

Place your water as far from the heat source as you can. Chicks don't like to drink really warm water, and water splashed on a hot bulb can break it.

Chicks and children

Children love fuzzy baby chicks, and young children often think of them as toys. But of course, they're not toys, and the decision to buy chicks for children should never be made on a whim. If your children are begging for the baby chicks they see in the farm store, don't buy them that day (unless that was your secret intention).

Tiny chicks are fragile, and even the loving squeeze of a small child can prove deadly. If the chest and rib cage of chicks are held so tightly that the chest can't move, the chick will suffocate even if the mouth and nostrils are clear. Children don't mean to squeeze, but they're often afraid of having the chick get out of their hands. So teach them: No squeezing.

Other problems result when chicks fall from the hands of children and are injured, or when they're picked up by their legs or necks. Adults should pick up chicks by scooping them up from underneath and carefully transferring them to a small child who, preferably, is sitting down. The child should be taught to cup both hands to hold the chick and not to hold it with one hand.

Even children who are old enough to properly pick up and handle chicks shouldn't be allowed to play with them too often. Taking the chick out of the brooder is stressful to it, and if chicks are too frequently handled, they may not grow as well and may become more susceptible to disease.

WARNING

Everyone needs to thoroughly wash their hands in hot, soapy water after handling chicks or chickens, their food or water dishes, soiled bedding, roosts — anything to do with chickens. Children are more likely to eat or touch their mouths or eyes without washing their hands and, therefore, are more likely to become ill from handling chicks. When toddlers are around chicken coops, prevent them from putting anything in their mouth that may have been contaminated. After handling chicks or adult chickens, children especially need to thoroughly wash their hands before doing anything else.

Pests and Predators

Most chicken owners have to deal with pests or predators at some point in their chicken-rearing. Having to endure losses from predators can be extremely frustrating and heartbreaking. As a keeper of domestic animals, one of your responsibilities is to guard your chickens and keep them safe. A predator in the hen house can ruin your day and end your chickens' days, so it's important to understand how to deal with the predators that roam your area.

Pests may not kill chickens and are usually more of a problem to the chicken-keeper than the chickens. They can spread disease however, and they often cost you a lot of money and time. Knowing how to manage pests is an important part of chicken keeping.

Preventing pests

Pests are creatures that don't directly kill and eat chickens or feed off them like parasites. Instead, they eat chicken feed or eggs. Preventing pests is always better than dealing with an established population. Be diligent, clean, and tidy, and pest problems may never bother you or your birds. The following list shows you several actions you can take to prevent pest problems:

- **Store feed properly.** Part of dealing with pest problems is storing feed products correctly. Be sure to store feed in insect- and mouse-proof containers. Metal trash cans with tight-fitting lids work best. Insects destroy the nutritional value of feed, and mice can eat through the bottom of a feed bag in seconds. After people discover how to store feed correctly and keep freeloaders from eating it, they're often amazed at how little their chickens actually eat.
- **Keep feeding areas clean and dry.** Clean up any spilled feed. Wet areas are most likely to support maggot growth, so keep the place dry as well.
- **Don't give rodents a place to hide.** Keep trash picked up, and remove piles of junk that can shelter rats and mice. Keep grass and weeds trimmed around buildings. Rats are more likely than mice to come from a neighbor's buildings or yard and to go from feeding at your place to sleeping at theirs, so you may have to enlist the help of the neighbor to control these pests.

- **Cover what you can.** Covering feeding stations and water containers outside can prevent wild bird droppings from getting into them. You also may need to cover your pasture pens with fine bird netting (like that used to protect fruit from birds).
- **Don't allow wild birds to nest inside buildings where you keep chickens.** This advice applies for all types of birds, from sparrows to swallows. Besides disease, wild birds can bring parasites such as lice to your chickens. Excluding the birds from the building and removing any nests you find promptly are the best ways to handle this.

Common culprits

The most common pests are insects and rodents. They occur in both rural and urban areas. Clean conditions, proper storage of feed, and an action plan (for when you start seeing signs of pests) are your best defenses.

- **Mice:** Chickens actually eat mice, so mice seldom set up housekeeping right in the chickens' home. Instead they work on the fringe, getting into stored feed, chewing up building insulation and wires, and running under your feet when you least expect them. Mice don't eat eggs, but they can eat and soil a lot of feed, cause allergy problems for some people, and spread certain diseases. It's best to try to get rid of them or at least control their numbers.

  Mice are controlled fairly easily with poison bait. However, place the bait where children, pets, and curious chickens can't get to it. If you're kindhearted and choose a trap that catches mice alive, you then have to do something with them. Don't just take them outside the door and turn them loose; they'll be back inside before you know it. The best bet is to take them to the woods or a field far from other homes where they can feed some animal you're trying to keep away from your chickens.
- **Rats:** Rats are larger, meaner, and more secretive than mice. They can eat eggs, and they've been known to eat baby chicks and even feed on larger birds as they sit on roosts or nests in the dark. Chickens and even most cats leave rats alone. Rats eat a lot of feed and destroy more by soiling it. They also do considerable damage by chewing on the structure and its parts, such as wiring and plastic pipes.

  Rats are suspicious of new things, so it may take days to get them to eat poison bait or fall victim to a trap. Traps must be placed close to pathways that rats habitually use. Traps aren't as effective at controlling rat populations as poison, however. Buy a poison specifically for rats, and change the type of poison you use from time to time so resistant populations don't build up.

Read the label to find out if the bait works with one feeding or multiple feedings. Remember to use bait stations to protect pets, children, and chickens, or place the bait where they can't find it.

- **Weevils, grain moths, meal worms, other insects:** Weevils, grain moths, meal worms, and other insects attack stored feed. They may provide a little extra protein for the chickens, but their feeding strips the nutritional value of the feed, leaving only husks behind. You know you've got grain pests if you notice fine webbing or tiny worms in your feed. Buy only the amount of feed you can use in about two months. Keep your feed in tightly closed containers, not open bags.

  TIP

  If you have a way to freeze feed for a few days, doing so will effectively kill most grain pests. In the winter, just leave the feed in your car for a few days when the temperature is below freezing. If you still have insects in the feed, use that feed promptly if it isn't too badly infested, or discard it if it is. Then thoroughly clean the feed container with hot, soapy water and allow it to dry in the sun. Metal and plastic containers are better to use than wood because they don't absorb moisture and insects and other pests can't chew through them as easily. Be sure to clean up any spilled feed, and empty and clean the feed dishes.

Protecting from predators

A predator in the hen house can be a huge frustration — and worse for the chickens it kills. *Predators* are animals that eat other animals or kill them just for fun. Chickens are high on the preferred food list for many predators. Some predators destroy all the birds they can when they gain access to a coop; others take one every so often when they're hungry.

Most chickens do little else but squawk and run to defend themselves, so knowing how to deal with predators is important. Case in point: it takes one loose dog just a few minutes to completely destroy a prized flock of chickens.

Predators are more likely to begin attacking poultry when the birds are raising young in the late spring or early summer, or in winter when food is scarce. And when predators find a good source of food, they often return. Remember that predators live in both urban and rural areas. In fact, some urban areas may have higher numbers of predators than rural areas.

The following tips can help you further protect your chickens from predators:

- **Be careful about letting your chickens roam.** Chickens that range freely may disappear without a trace. In areas with heavy predator presence, letting chickens roam freely may be impractical. Keeping chickens penned until later in the morning and bringing them in early in the evening can help.

- **Prevent nighttime attacks.** Good, predator-proof shelters can be closed up at night. A light left in the coop at night further ensures the safety of your chickens.
- **Cover coop windows.** Put strong wire over open shelter windows.
- **Keep an eye out for dogs.** Keep your own dogs from chasing chickens, even in play. If neighbors let their dogs run loose all the time, your chickens are probably going to need to be penned up.
- **Fence your chickens in.** Pens of sturdy wire are the best protection your chickens can have. If raccoons are around, you need strong, welded wire to keep them out. To keep out larger predators, a foot of heavy wire bent outward at the bottom of the run fencing and either buried or weighted down with large rocks is advisable.

  Electric fencing is effective at keeping raccoons, foxes, dogs, and coyotes out of chicken pens. A single strand of electric wire near the top of outside runs and near the bottom of any flexible fencing should keep them out. (For more on keeping critters out of certain areas of your homestead, refer to Book 1, Chapter 1. And to learn about installing certain types of fencing, such as electric fencing, go to Book 1, Chapter 3.)
- **Steer clear of trees.** Make sure predators can't jump off nearby trees into the pen or get on the roof of the coop from nearby trees.
- **Beware of aerial attacks.** If you let your chickens roam, choose dark-colored birds, which are harder for birds of prey to spot. White birds are easy pickings if they roost outside at night, so make sure they roost inside. If hawks and owls take chickens out of fenced runs, you may need to cover them with nylon netting or fencing.

Tracking the transgressor

The most common predator of chickens is the dog; this animal may be man's best friend, but it certainly isn't a chicken's. However, many other predators occur in both urban and rural areas as well.

Determining which predator killed or injured your chickens can sometimes be difficult. If a chicken simply disappears, it's probably impossible to find out what happened, but in some cases, you may find clues. examine the victims and chicken housing closely and consider the following questions:

- Can you see an obvious way the predator entered, such as through a large hole in the fence?
- Has more than one bird been killed?

- Were the birds eaten or just killed?
- What part of the body did the animal feed on, and where are the wounds?
- Were eggs smashed or carefully cracked? If cracked, how were they opened?
- Do you see animal tracks in snow or mud?
- Do you live in an urban or rural area and/or by water?

Table 4-1 can help you answer these questions.

TABLE 4-1 Figuring Out Whodunit

Predator	What It Hunts	Hunting Hours	Signs
Dog	Chickens	Day or night	Chickens killed but not eaten; survivors may have deep puncture wounds or large pieces of skin pulled off; scattered blood and feathers
Opossum	Usually eggs; occasionally chickens	Night	Droppings look somewhat like cat droppings; tracks similar to tiny human handprints, with five toes and one toe pointing off to the side or backward on the back feet; one chicken killed at a time and partly consumed; eggs usually cracked and eaten in the nest
Raccoon	Baby birds and eggs but also capable of killing adult birds	Night	Several or all birds killed; heads bitten off; flesh torn from breast area; pieces of flesh and blood around water container; feed bags and bins trashed
Fox	Chickens	Early morning and late evening	Chickens free-ranging or pastured away from humans in a rural area; may find partially buried carcass of a bird
Coyote	Chickens and sometimes eggs; seldom enter chicken housing	Mostly night; may hunt during day in cold weather if there's little human activity	Several birds missing at once
Hawk, eagle, or owl	Baby chicks or adults; large hawks, eagles, and large owls can kill adult chickens	Hawks and eagles during day; owls mostly nights, though sometimes days during winter	Hawks, eagles: Birds carried away or picked apart on the spot where killed Owls: Birds plucked from roost and carried outside; in coop, heads may be pulled off, with a single bite taken out of each breast
Mink or weasel	Chickens, eggs, and rats	Day or night, but they shy away from human activity	Chickens kept in rural areas near water sources; heads bitten off; small amounts of flesh eaten; birds may be piled up

Expecting Eggs (for Eating)

Getting hens to lay well and keeping them laying takes a little more care than many people think, but something about producing some of their own food makes many people want to try. Our focus is on producing eggs to eat rather than incubating them to produce more chicks; here we discuss hen management and problems you may encounter with egg laying. The only thing breeders of eggs for hatching need to do differently is add a rooster!

Because it takes more than 24 hours for an egg to work its way from being released from the ovary to being laid, a hen can't lay an egg 365 days a year. Some high-producing hens have been known to lay 300 eggs the first year, but your home-raised hens will probably lay between 200 and 250 eggs their first year of laying if they're a breed developed for egg production.

If you have production egg layer breeds, such as Isa Browns, Pearl Leghorns, or Cherry Eggers, and they're well managed and healthy, they'll probably produce five to six eggs a week in their first year. Other breeds, such as Orpingtons, Plymouth Rocks, and so on, will probably produce four to five eggs per week. Some fancy breeds, such as Polish, Modern Games, Houdans, and so on, produce fewer eggs in a more seasonable pattern — higher in spring and summer, and lower or absent in fall and winter. If you have mixed-breed birds, your egg production will vary widely.

A family that's keeping four hens from a good egg-laying breed can expect to collect about 18 eggs a week, at least in the first year. You may get lucky and collect up to two dozen eggs. Remember, some eggs you collect may be cracked or otherwise unusable.

Providing encouragement

Hens begin laying anywhere from 18 weeks to one year of age, depending on breed and what time of year it is when they mature. In breeds bred for egg production, laying usually begins around the 22nd week.

Pullets (young hens) like to play house as their hormones begin to prepare them for laying. If they have the proper nest boxes available, they'll try them out by sitting in them, arranging nesting material, and practicing crooning lullabies. Dark, comfortable, secluded nest boxes attract them. Try to have nest boxes in place by the 18th week.

You can keep adult hens laying more reliably when you use artificial lighting to supplement natural light. The length of the day and the intensity of light stimulate the hormones of hens and prompt egg-laying. In the winter, hens that get only natural light may stop laying, but if you add artificial light, you can keep your hens laying. Fourteen to 16 hours of bright light followed by 8 to 10 hours of dim light or darkness is the ideal lighting ratio to keep hens laying. Many people buy a timer for the coop lighting so that they don't need to get up early or go out late to turn lights on and off.

Just as most animals are at their best in calm, comfortable surroundings, your hens lay better in those kinds of situations. Make sure your hens have everything they need to be comfortable — good feed; clean water; dry, clean surroundings; nest boxes; roosts; and maybe a sandbox to bathe in.

Don't disturb hens too much in the morning before laying. It's not the time to bring in visitors, catch birds, or clean the coop. You can do your normal feeding and watering, but you may want to avoid providing extra treats that cause everyone to come running.

Getting your eggs in one basket

Get yourself one nice basket, pan, or bowl to handle your largest egg collection, and faithfully collect your eggs each morning. If you have free-range hens and you can't confine them until after they lay in the morning, get used to checking several locations each day where the hens are known to lay. With hens that lay in nest boxes, collecting the eggs is easy. If you have free-range hens, you may find eggs popping up in all kinds of unexpected places.

Hens lay most eggs within a few hours after sunrise, which, of course, varies with the season. If your coop is lighted for egg production, your hens will lay most eggs before 10 a.m. Try to collect eggs soon after your hens have finished laying. This keeps them from being broken, which keeps hens from learning that they're good to eat. It also gives other animals less time to raid nests. If you can't pick up the eggs soon after they're laid, at least pick them up once a day. If you have a lot of hens, you may want to schedule morning and evening collection times.

TIP

If you find eggs and you're not sure how old they are, you can try one trick. Fill a large bowl with water and gently put the eggs in it. Eggs that sink on their side are probably fresh. Eggs that stand upright or that float are probably old and need to be discarded. As an egg ages, it loses moisture and the air space gets bigger, which causes the egg to float.

The color of eggshells ranges from chalk white to deep chocolate brown. Some chicken eggs are green, blue, olive, or khaki colored. Light brown eggs may have a rosy tint, but you won't find any red, orange, or pink eggs unless the Easter Bunny leaves them.

REMEMBER

The important point to remember about eggshell color is that it has nothing to do with taste or the nutrient content of an egg. It also has nothing to do with the internal yolk color. We think brown eggs have gotten a reputation for tasting better because they're often the eggs produced at home or locally and are therefore fresher.

If you like the look of white eggs or your kids refuse to eat any eggs that aren't white, nothing is wrong with producing white eggs at home. Your home-produced white eggs will taste much better than store eggs and will taste every bit as good as brown eggs.

Cleaning your cache

Some people recommend storing eggs without washing them, but even if you work hard to keep fresh, clean nesting material in your nests, some eggs are going to get dirty. Usually they're dirtied by chicken poop, but sometimes a broken egg, muddy hen feet, or other contaminants will soil them. We think that keeping dirty eggs in the refrigerator is a good way to spread harmful bacteria. Even if they look clean, we recommend washing all eggs before storing them.

Rinse eggs in running, mildly warm water, washing all sides. Don't scrub too hard — sometimes eggs have rough spots or "pimples," and if you scrub these off, you damage the shell and allow the inside to be contaminated. Use a paper towel to scrub eggs; never use abrasive pads. Discard towels after each egg, for best food safety.

TIP

After washing the eggs, dry them with paper towels before placing them in storage. Wet eggs can stick to cartons or other containers, and then when they're picked up, a piece of the shell may come off.

Storing and handling eggs

Always store clean, dry eggs in the refrigerator at about 40 degrees. Fresh eggs remain safe to eat for several days at room temperature, but they lose quality quickly. Always store eggs in covered containers that retain some moisture. Store the eggs with the large end up. Never freeze eggs in the shell. The shells will crack, and bacteria can contaminate the inside of the egg.

The egg carton was designed to keep eggs fresh and safe and home flock owners can use cartons to store eggs too. You can recycle cartons from store-bought eggs or you can purchase cartons from poultry supply catalogs and feed stores. Egg cartons allow you to stack the eggs to save room, and they allow you to easily mark the carton with a date so you know when you collected the eggs. Eggs remain edible for a couple months if properly stored.

TIP

The easiest way for homeowners to store eggs for a long time is to freeze them. Before freezing, crack them into a bowl with a pinch of salt or sugar (discard the shells) and then lightly beat them. You can combine the eggs in twos, threes, or other amounts you find useful and freeze them in baggies or small containers. Frozen in this way, the eggs remain good for about six months. You can use them in cooking or making scrambled eggs after you thaw them.

Always discard eggs that are cracked, soft, or thin-shelled and eggs that look or smell bad. Eggs that are really dirty have a heavy bacterial load and probably should be discarded. After three months in the refrigerator and six in the freezer, discard the eggs.

If you have a lot of excess eggs, you may be able to sell some. The USDA allows people to sell eggs without USDA inspection if they have fewer than 3,000 laying hens, sell less than 30 dozen eggs at a time, and sell only eggs they produce on their farm. However, almost all states add regulations for eggs sold without USDA inspection. Before you sell eggs, check to see what the laws in your state and local area say about home egg sales.

IN THIS CHAPTER

- **Introducing rabbits, goats, and turkeys to your homestead**
- **Getting your feet wet with ducks, geese, and fish**

Chapter 5

Opting for Other Animals

You've probably already shared your home with a dog or cat or two. But a backyard homestead open up opportunities for sharing your farm with other types of animals that you may not have dealt with in the past.

Dogs, of course, are one of the best early warning systems: great foretellers of potential danger and also great lifeguards for when you walk out to the garden late at night to check on something. And cats live to manage your local population of not only rodents, but other critters who can wreak havoc on your gardens, chickens, and vegetables.

But besides the flock of hens you maintain for eggs and maybe meat (as discussed in Chapters 3 and 4 of this minibook) and the bees you keep on-site for honey and pollination purposes (see this minibook's Chapters 1 and 2), you may want to have other animals around as residents of your homestead.

This chapter gives you a few options to consider. But this is by no means an exhaustive list of what you can do on your homestead. Want to have horses? Corral cattle? Parent pigs or chaperone sheep or llove your very own llamas? You can if you have the acreage and the inclination, but you're inching your way toward *farming* rather than *homesteading*.

Four our purposes here, we keep it pretty basic. But feel free to take these ideas as a starting point and use your imagination to come up with something unique that works especially for you.

Raising Rabbits

You've no doubt heard the phrase *tastes like chicken* when someone is describing an unusual meat. Well, that description holds true for the meat of the rabbit, which is low in cholesterol. Rabbits, which eat grass and leafy weeds, are more productive and are cheaper to feed than chickens. A rabbit can produce up to 1,000 percent of her body weight in food per year, which brings new meaning to the phrase *multiplying like a rabbit!* You can skin and butcher about five rabbits in the same amount of time it'd take to do a chicken.

Rabbits also produce a fine, soft fiber. Rabbit fur is very soft, and people have used rabbit pelts for years as fur accents on coats or hats, among many other uses.

The fiber of the Angora rabbit can also be spun into a super soft yarn known simply as *angora.* Rabbits such as the Angora shed their coats a few times a year. (Yes, that means you can get the fiber and still keep the critter.) The rabbits should be brushed regularly to keep the coats free of knots, and the stuff you brush off can be added to the pile that you can later spin. For rabbits who don't shed their coats, you can shear them or you can brush or hand-pull the loose fibers out. (You know it's time to harvest the rabbit's fur when you notice clumps of wool sticking to the cage.)

Here are a few things to consider:

- Rabbits don't need much space to be happy. They should be kept confined to reduce the threat of predators.
- Take care when building their enclosures to ensure their safety. Hutches should be well above the ground and out of the way of curious dogs and other smaller critters, such as skunks.
- Because Angora hair is so long and soft, it has a tendency to mat and shed. (Matted fiber is no good.) Shedding not only means the loss of potential spinning fodder but can also make a mess of the cage and cling to your clothes. Regular brushing is crucial.

Rabbits, like other animals, need protection from predators, and the very dogs that you use to guard other animals may be the same critters that threaten the rabbits. Outdoor rabbit houses, called *hutches,* are typically aboveground, secured shelters, so dogs (and skunks, raccoons, and coyotes) can't even get close to them.

The bottoms of the cages are typically a wire mesh-type material so the frequently produced poop can flow freely out of the cage. The hutches my dad used had chicken wire on three sides and on the bottom, and the other side and the roof were wood. Such wire-and-wood hutches can adequately protect the rabbits from the weather (rain, snow, and so on); for warmth, you can put some straw or other bedding materials inside.

WARNING

Keep the hutches inside fences where predators can't get close. When rabbits get nervous and freak out, they kick. The kicking feet can go down through the wire mesh, damaging the rabbits' feet and legs. They can wear their hocks down to nothing (a *hock* is like an elbow on the back of the leg). This can lead to bone infections that are nasty to deal with and are pretty much fatal.

Getting Your Goats

Goats are fantastic animals that have been domesticated for more than 10,000 years, and they are a great way for the modern homesteader to become more self-sufficient.

Imagine never having to buy milk or cheese again. If you raise dairy goats you can achieve that goal. Your goats need to have kids to give you milk, and then you can milk them throughout the year for up to three years without re-breeding, if you want. Or you can stagger the kidding each year so that you have a milk supply year-round. Just one standard-size dairy goat can give you an average of 6 to 8 pounds (3 to 4 quarts) of milk each day. And, depending on the butterfat content of the milk, you can get up to a pound of cheese for every gallon of milk.

Goat meat has always been popular in the developing world, because goats are much more affordable and use fewer resources than animals such as cows. According to the U.S. Department of Agriculture, the demand for goat meat is expected to continue growing. Goat meat is easily digestible, tasty, and low in fat. If you're in charge of your own source of meat, you know how it was raised and what feed or medications went into it.

If you raise fiber goats, you can spin your own yarn and make hats, blankets, sweaters or other products. You can also sell the fiber to spinners or to companies that make these products, while having the benefit of these friendly creatures.

Goats are also well-known for their ability to wipe out weeds. In fact, some people have made businesses out of renting out their goat herds to cities and other municipalities to clean up areas that are overgrown with weeds or blackberry bushes. But be warned: your goats will treat your vegetable garden like a salad buffet if given access, so keeping your goats contained is key.

WARNING

Goats tend to be escape artists, so fences need to be strong and sturdy. Chicken wire and a couple of metal posts aren't enough — you need something stronger, such as chain link or metal fence panels.

REMEMBER

Check out ordinances in your area regarding keeping livestock. you may need to buy a license for a goat, just like you do for a dog. In some cities, you can't keep backyard goats. In an urban area, even if goats are allowed, your neighbors may complain, much like they do with a barking dog. Be aware of what your local noise ordinance covers.

Goats need a safe, clean place to hang out, sleep in, or retreat to when the weather is too hot, cold, windy, or rainy. Consider buildings that are already on your property that may be feasible for housing goats. You can remodel a chicken house or other farm building or even use a prefab garden shed for a goat house. Many people house urban goats in a section of garage that opens into the back yard.

Finally, run the numbers! In almost all cases, getting only one goat is a recipe for trouble. Goats are not dogs and do not thrive on human companionship alone. Goats are herd animals and need other goats to keep them healthy and happy. A goat without a friend will cry and can even become depressed. Never get just one goat; always buy at least two goats so they can keep each other company. That said, start slow and don't get the maximum number of goats that your homestead can handle right away. And then think about what you are doing when you start breeding your goats. They grow exponentially, and all of the kids are way too cute!

Figuring Out Fowl: Ducks, Geese, and Turkeys

Many chicken-keepers add other poultry to their backyard flock. In general, ducks, geese, and turkeys get along well with chickens. However, you may need more room than a small backyard to keep them with chickens. All of these birds need to be kept where they have a lot of space to roam and a place to bathe.

Ducks and geese

Ducks are typically raised for their meat, eggs, and down. Their meat is a more exotic one and is often used in gourmet foods in pricey restaurants (*foie gras* is one example). Their eggs are larger and richer than that of a chicken and thus are prized among chefs.

They're a popular animal to have on the farm because they're easy to care for (they're happy with kitchen scraps), they eat bugs, and they're just fun to watch. They can also act as alarms and fend off small predators.

Geese are hardy birds and aren't as susceptible to diseases as some of their poultry cousins. They're easy to care for because they're foragers — by eating their favorite food, they help control your weeds. They even love grass clippings. Their eggs are a delicacy, and their feathers (particularly their down) make for soft and warm insulation material.

WARNING

Be aware that most ducks and geese can be noisy, and neighbors may not welcome them.

You can mix ducklings or goslings (baby geese) with chicks in a brooder without them harming each other. However, you'll need a plan for meals. We usually recommend that chicks start out with medicated feed, but ducklings and goslings shouldn't have medicated starter feed because they're sensitive to the antibiotic used. Since you can't keep them from eating each other's feed, all the babies will need unmedicated feed. This compromise may then lead to more disease problems in the chicks.

We recommend using a higher-protein feed, such as broiler feed, for ducklings — the chicks will be okay with that choice, too. As adults, ducks, geese, and chickens can eat the same feed, although special feed mixes for ducks are available.

Keep in mind that ducks are messy, even when they're ducklings. They'll play in the water, and their droppings are more liquid than chicks, so brooders with ducklings need more frequent cleaning to keep them dry. Ducklings don't need to swim while in the brooder (although they will if they can fit inside the water container), and it's not recommended to let them bathe if you're keeping them with chicks. Goslings aren't quite as messy with water.

Geese can be aggressive, and they go after unfamiliar visitors who come into their territory. And because geese are rather big birds, they're capable of defending themselves and their territory against small to medium predators such as raccoons or weasels. But their biggest guarding benefit is that when they're upset, they don't stop squawking until the danger is gone. As long as you're home, you'll be notified that something is amiss out in the yard and that you should go check it out.

Ducks can be territorial, too, going after and nipping at a critter who doesn't belong, but they're not so big and are no match against larger predators.

You'll need to address one other consideration when keeping ducks with chickens. Don't keep male ducks with chickens without female ducks also being present.

Ducks are often aggressive sexually. If they're deprived of their own females, they may mate with hens.

Mother hens and ducks sometimes raise each other's babies when allowed to mingle freely. They may lay in each other's nests and sit on each other's eggs. Chicks don't usually follow a stepmama duck into water, but it has happened. Baby ducklings can confuse a hen when they pop into water to swim, but it rarely causes a problem.

Turkeys

Turkeys, of course, are the most popular Thanksgiving meal. Turkeys need to be a bit older than chickens do at slaughter — hens (females) should be 14 to 16 weeks old, and toms (males) should be 19 to 20 weeks.

Most commercial turkeys are bred to have a lot of meat on them, and that means they're unable to fly. That also means you should provide shelter — protection not only from the elements but also from predators, because they can't fly up to the top of the barn if something gets too close.

Turkeys eat grain (with a little higher protein content that what you'd give a chicken) and have a life expectancy of about ten years.

Goin' Fishin'

Fish can be fun to raise because they're rather easy to care for, but what types and even whether or not you can do this depends on your state's laws. The most common types of farm-raised fish are catfish and trout.

If the fish are for your own enjoyment, you have little to do in the way of caring for them. For instance, if you have a natural pond on your property, you don't have to do much besides catch them. With human-made ponds or repurposed pools, you need to take care of feeding them and keeping their homes pest-free.

If you're raising fish (such as tilapia, perch, catfish, or trout) for food, you have more health-related issues to consider, such as being careful about the herbicides you use for controlling aquatic plants and keeping the fish disease free.

Fish raised in captivity have some problems their wild counterparts do not. Their diet is different, so they can have a different taste or color. They also have less room to swim and can be prone to diseases, so you have to consider using antibiotics.

5

Building It Yourself

Contents at a Glance

CHAPTER 1: **Starting Small with Garden Projects** 561

Making an A-Frame Trellis 562

Crafting the Ultimate Tomato Cage 563

Building Raised Garden Beds 565

Constructing a Cold Frame. 567

Elevating Your Rain Barrel on a Stand 568

Organizing Made Easy with a Tool Wall 570

Creating a Compost Bin (or Two) 573

Whipping Up a Walk-In Hoop House 578

CHAPTER 2: **Building a Backyard Beehive**. 581

Choosing Materials 582

Protecting Your Hive with Paint and More 586

Building the Kenya Top Bar Hive. 587

CHAPTER 3: **Building a Chicken Coop**. 603

Choosing Materials 604

Selecting the Right Coop for Your Flock. 611

Constructing the Alpine A-Frame Coop 616

IN THIS CHAPTER

- Building trellises, tomato cages, raised beds, and cold frames
- Making a rain barrel stand, outdoor tool wall, compost bins, and a walk-in hoop house

Chapter 1

Starting Small with Garden Projects

For some homesteaders, the self-reliant streak that got them started on growing and preserving their own food manifests itself in other ways, too. Just like that bumper crop of tomatoes, why buy from the store what you can produce yourself? It's no surprise, then, that many homesteaders are avid (or at least enthusiastic) do-it-yourselfers.

Building some of what you need in the garden lets you customize things to suit your conditions and needs. Repurposing materials you may already have is a great way to recycle items that might otherwise end up in a landfill. And face it, if you're making it yourself and not paying retail, that's more money you can spend on plants (or seeds or tools or chicken feed or canning jars or any number of other things that homesteaders get excited about).

Even if you don't consider yourself particularly handy, this chapter has some ideas for DIYing some of your own small projects around the garden. You feed your family with food you grew from seed; you can certainly handle the easy builds contained in this chapter.

Making an A-Frame Trellis

Some vegetables have climbing or sprawling habits that require some kind of support as they grow. (Figure 1-1 shows some common techniques.) Twining or clinging plants such as beans and peas grow best when they're supported by some type of string trellis. An A-frame string trellis enables you to grow plants on both sides, but single poles are fine, too.

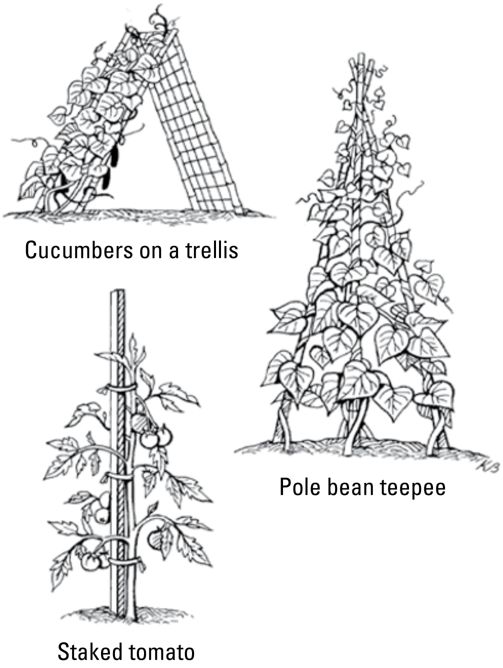


FIGURE 1-1: Techniques for supporting vegetables.

Making an A-frame string trellis is easy; just follow these steps:

1. **Using at least six 2-by-2-inch redwood or cedar stakes, build two 6-by-6-foot squares.**

   Redwood and cedar stakes are naturally rot resistant and good choices.

2. **Secure the corners of the squares with metal corner braces and connect the two squares on one side with sturdy hinges.**

   The hinges enable you to easily move or store the trellis.

3. **Hammer small nails at 2- to 4-inch intervals along the top and bottom of the trellis.**

   Don't pound the nails in all the way; leave about 1 inch sticking out.

4. **Weave some sturdy twine or string up and down the trellis, between the nails.**

   Bingo; you have an A-frame string trellis.

Handmade wooden teepees are a great way to support your beans, and kids love them because they're great places to hide. Here's how to construct your own teepee:

1. **Using four to six 2-by-2-inch redwood or cedar stakes that are 6 to 8 feet long, form a conelike teepee.**
2. **Tie the stakes together with twine at the top of the teepee.**
3. **Run some string or twine around the bottom of the teepee, securing the string or twine at each stake with a small nail.**
4. **Run more string back and forth around the stakes, from the top of the teepee to the bottom, leaving several inches between each run.**

Leave one side of the teepee open so your kids can get inside, and then plant beans around the base of the teepee. In time, the beans will cover the trellis, creating a great fort for your kids.

Crafting the Ultimate Tomato Cage

You've no doubt seen the inexpensive cone-shaped tomato cages at your local gardening center. And if you've ever grown tomatoes, you've probably bought more than your fair share of them. They're easy to come by, sure, but let's be honest: they're flimsy and don't hold up well from season to season, and most of the time, they're not even tall enough to support your tomato plants into late summer!

If you're willing to spend just a little more money and invest a few minutes of your time, here's a way to solve all those issues with strong, sturdy, supersized tomato cages that may be the last ones you'll ever need (see Figure 1-2). The idea comes from Joe Lamp'l, host of the TV series "Growing a Greener World" and the website `www.joegardener.com`.

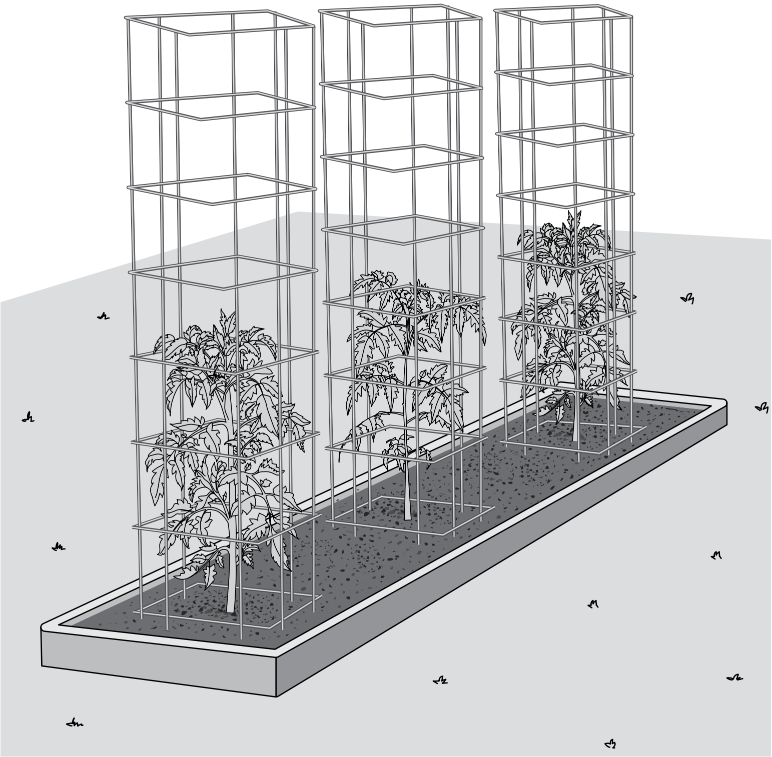


FIGURE 1-2: The ultimate tomato cage.

Go to a farm supply store and buy *cattle panels* or *livestock panels*. They're welded grids of galvanized steel rod, with openings about 6 inches square. Think chicken wire or hardware cloth, but much bigger and exponentially stronger. Each panel is 16 feet long and over 4 feet wide, and you'll be able to make one tomato cage per panel. They're somewhat pricey at about $20 apiece, but the cages you make from them will last forever; you'll never have to buy one of those flimsy cones again.

Arm yourself with a pair of heavy bolt cutters and have some strong nylon zip ties ready. That's all you need. Your new tomato cage takes just minutes to make:

1. **Cut the panel lengthwise.**

   Place the panel on a flat work surface such as your driveway. Count down six squares, and cut the length of the panel to make a section that's 16 feet long and just six squares wide.

2. **Divide the new section into two equal pieces.**

   Count down nine squares and cut across the panel just above the horizontal bottom bar of the ninth square. You'll be left with eight full squares and a set of long spiky ends. These ends will be the stakes that anchor the cage in the soil. You can remove one more set of horizontal bars to make extra-long stakes if desired. Repeat this step to make a second matching section.

TIP

Save the scrap pieces! You'll likely find all kinds of uses for them around the homestead, from handy layout guides for even plant spacing to miniature trellises for other garden vines and climbers!

3. **Bend the sections to form 90-degree corners.**

   Working with one section at a time, place a 2 x 4 over the grid, running lengthwise at the halfway point. Stand on the 2 x 4, grab one edge of the wire, and pull. The idea is to bend the wire up against the 2 x 4 to make a long L-shaped corner piece.

4. **Put the bent panels together to create a square-shaped column.**

   Drive the stake ends into the planting bed. Position the two pieces to form a tight square column around the plant. Having two sections means you can assemble the cage around delicate plants instead of trying to carefully lower one of those cone-shaped cages over the top of a maturing plant.

5. **Lash the panel pieces to one another with zip ties.**

   It's easy to cut the ties after the harvest and separate the panel pieces for easy stacking and more compact storage.

Building Raised Garden Beds

Raised beds relieve the tedium of bending over to plant, weed, and care for your vegetables and flowers. They also offer a way to terrace a sloping yard or solve soil problems, such as excess clay or rocks. (More about incorporating raise beds into your overall plan in Book 1, Chapter 1.) You can even gopher-proof your raised beds to control these pesky varmints. Figure 1-3 shows an example.

Although a raised bed is nothing more than a large, bottomless box, some designs include a wide enough edge around the top for sitting or setting things on. Raised beds vary in height from 8 to 18 inches, depending on the material you use. Make the beds no wider than 4 feet, so that you can reach the interior areas. They can be any length you want, although multiples of 4 generally let you take good advantage of standard lumber lengths with little to no waste. Plan 30 inches of space between beds for wheelbarrows and easy access.

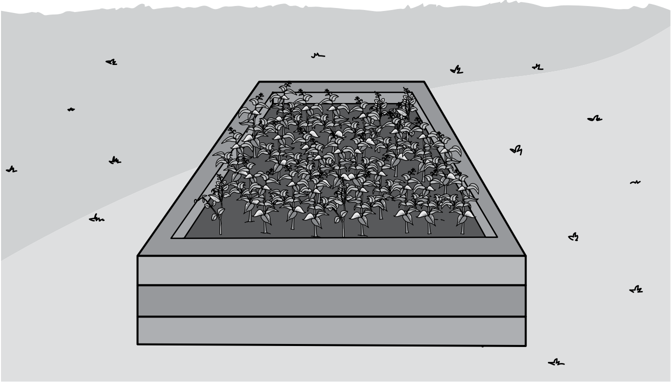


FIGURE 1-3: A raised garden bed built from stacked 2 x 8 lumber.

For a lumber bed, use 2-by-boards, such as a single 2 x 12 or a pair of stacked 2 x 8s. For a bed measuring 4 feet wide by 8 feet long, for example, you would need three 8-foot lengths (or two 12-foot lengths) of lumber for each layer. Use heartwood lumber of a durable species. To build a lumber bed, do the following:

1. **Drive 4 x 4 stakes into the ground at the four corner locations and every 4 feet along the long sides.**

   Use stringlines to keep them aligned and a level to keep them plumb.

2. **Cut the side pieces to length and place them around the outside of the 4 x 4s to make a box.**

   After you level each piece, clamp it to the 4 x 4s, drill ⅝-inch diameter holes through the lumber and stakes, and bolt them together with ½-inch carriage bolts.

3. **If you stack boards, overlap the corners log cabin style.**
4. **After you attach all of the side pieces, trim the 4 x 4s flush with the tops of the sides.**
5. **For a seat, install 2 x 8s around the top of the box. If necessary, reinforce the 2 x 8s by attaching a 2 x 4 cap piece around the top of the box.**

   Cut the ends at 45 degrees for miter joints (joints with no end grain showing, like a picture frame).

6. **Position the 2 x 8s on the 4 x 4s and the top edge of the side pieces, and attach them with 3-inch galvanized deck screws.**

TIP

To keep burrowing animals, such as gophers, out of your raised bed, cut metal chicken wire or hardware cloth to fit the bottom of the box. Secure it to the sides with poultry-netting staples before filling the box with soil.

Landscape timbers, also stacked log-cabin-style, make an extra-sturdy, wide-ledged bed that's attractive and easy to build. Stack 6 x 6 timbers two or three high. Check the first course (layer) with a level before adding the second two courses. Drill ½-inch diameter holes through each timber, aligning the holes over each other. Drive ½-inch *rebar* (rod used for concrete reinforcement) into the holes after you stack the timbers to lock them in place.

Constructing a Cold Frame

Cold frames are essentially are mini-greenhouses. They're usually wooden boxes covered with windowpanes or clear plastic (see Figure 1-4). Some professional gardeners as far north as zone 5, where winter temperatures can dip down to −20 degrees Fahrenheit, can harvest vegetables every month of the year by planting cold-weather-tolerant crops in cold frames. You can learn more about extending your growing season with cold frames and greenhouses in Book 1, Chapter 7.)

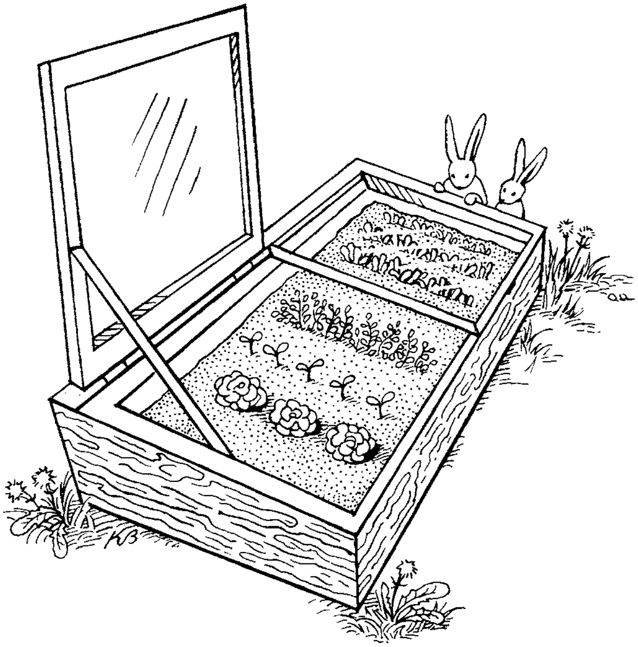


FIGURE 1-4: A sample cold frame.

Although anyone with a credit card can purchase a premade cold frame for $100 to $200, you can easily create your own simple cold frame by following these steps:

1. **Build a 3-foot-x-6-foot box from untreated lumber. Cut the box so that the back is 18 inches high, sloping to a front height of 14 inches.**

   This sloping angle enables more sun to reach the plants, and it sheds rain and snow as well.

2. **Hinge an old window sash over the top of the cold frame or make a frame by using tightly stretched clear plastic, which creates a sealed growing environment.**

   You can insulate the cold frame by adding rigid foam insulation around the insides of the cold frame and by weather stripping along the top edge.

3. **Position the cold frame so that it faces south.**

   It's best to put a cold frame next to a structure, such as a house, to protect it from cold winds.

REMEMBER

Even though the purpose of a cold frame is to trap heat, on sunny days, even in winter, a cold frame can get so hot that it burns the plants. Check your cold frame once a day on sunny days, opening or venting the top slightly to allow hot air to escape.

Elevating Your Rain Barrel on a Stand

Harvesting rainwater from your gutters into a barrel and using the water to irrigate your planting beds is a wonderful way to make the most of this precious resource that just falls freely from the sky. The easiest way to use that captured water is with a simple garden hose, but you need gravity to help. The barrel must be higher than the hose to get running water when you turn on the spigot. Therefore, every inch off the ground you can situate your rain barrel, the better. That's where a rain barrel stand comes in, as shown in Figure 1-5.

WARNING

A gallon of water weighs over 8 pounds. A full rain barrel can easily tip the scales at over 500 pounds! The moral of the story is: If you're going to elevate your rain barrel, don't skimp. Flimsy building materials, using too few fasteners, or inadequate barrel support can make a serious mess or cause physical harm if that rain barrel comes crashing down.

Using just a bit of basic lumber (maybe even scraps you already have), you can construct a simple and sturdy stand that raises your rain barrel to a comfortable height that ensures the water is always flowing freely in your garden.

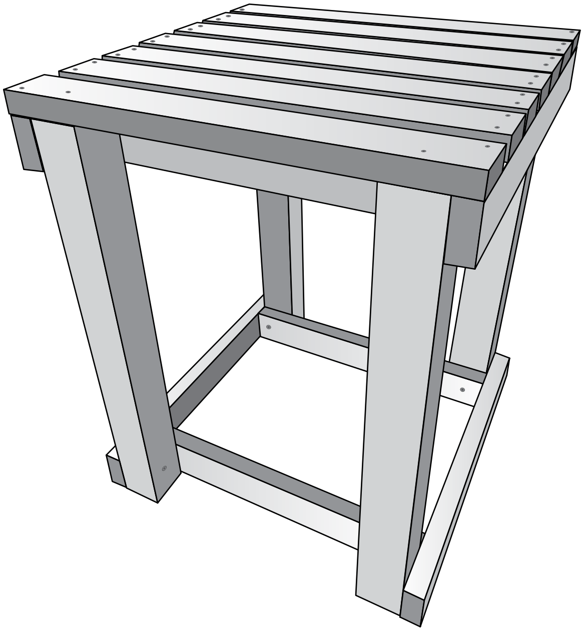


FIGURE 1-5: A simple rain barrel stand.

Just follow these steps:

1. **Cut 4 pieces of 4 x 4 lumber to a length of 34½ inches.**

   These are the legs of your rain barrel stand. They'll put your barrel on a surface 36 inches off the ground; cut your legs shorter as needed.

2. **Cut 11 pieces of 2 x 4 lumber to a length of 29 inches (4 supports, 7 top planks) and 4 pieces to a length of 26 inches (stretchers).**

   If you're buying new lumber, 5 8-footers will give you more than enough wood.

3. **Build two sides.**

   Fasten two supports horizontally to a pair of upright 4 x 4 legs. One support should be flush with the tops of the legs; the other should sit flush with the bottoms. The outer edges of the legs should sit 29 inches apart. Make sure the corners are square. Repeat for the second side piece. Build on a level surface so that the stand will be level after it's completed.

   TIP

   Outdoor-rated 2½-inch deck screws will be sufficient for this project. Drill small pilot holes before driving the screws to prevent the wood from splitting.

4. **Join the sides with stretchers.**

   Connect the side pieces to one another with two stretchers at the top and two at the bottom. Fit the stretchers between the top supports and inside the stand, fastening them at both the supports and the 4 x 4 legs. You should end up with the skeleton of a square column, 29 inches by 29 inches.

5. **Add the top planks.**

   Evenly space the 2 x 4 top planks by leaving a gap between the boards. Fasten them with screws driven through the planks and into the supports underneath.

You may choose to finish the rain barrel stand with paint or stain, or to add hardware that allows you to hang your hose directly on the stand.

Organizing Made Easy with a Tool Wall

All of those shovels, rakes, hoes, and other tools you use to keep your homestead running take up space. But for many gardeners, that space isn't conveniently located to the garden they're actually working. That means a lot of wasted time trudging back and forth retrieving and returning tools.

Plenty of gardeners have come up with a nifty way of stashing their tools *in* the garden, so that everything they need is within easy reach at a moment's notice. It's often called a *tool wall*, and it's exactly what it sounds like: a vertical surface where your various homesteading implements live when they're not being used. Check out Figure 1-6 for an example.

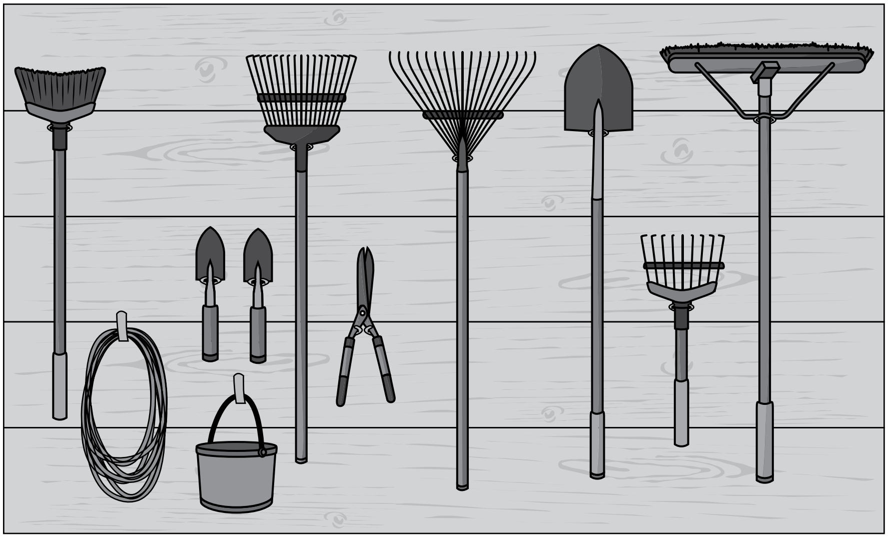


FIGURE 1-6: An outdoor tool wall.

Hanging tools on a wall is not a radical idea, but once you start looking around your yard, you may be surprised at the number of places you could put this concept to work with your gardening gear. Any exterior wall of a house, garage, barn, or shed can be used to hang tools. You could turn a section of existing fence into a tool wall. You could even erect a portion of a wall specifically for this purpose, and have it do double-duty as a windbreak or privacy screen. Plus, it can make an eclectic focal point in the yard and add a bit of character to the homestead . . . all while helping you be more organized and efficient.

The best tool walls offer a maximum of flexibility with a lot of square footage that can be used for tools of varying sizes and shapes. Sure, you can place some hooks all in a row on a single board and mount it to a wall, but there's a good chance that some of the tools you'd like to hang won't fit well with others. Some tools hang by their handle, some upside-down by the business end. Some tools are quite tall; others become harder to reach if they hang too high. Some tools might hang well off a bare nail, while others may need a curved hook or a long arm or a double-pronged piece of hardware. It's about making all of your tools fit, not lining them up in perfect rows at a uniform height.

Ideally, you probably want the ability to move tools around as you acquire new ones. Being able to unscrew a hook, move it over 3 inches and down two, and simply screw it back in to the wall at the exact spot that allows your new compost fork to have a home is something you'll appreciate; so much the better if you're not worried about the screw hole left behind in the wall of an old barn or on an expanse of wood that was designed for the purpose.

TIP

An outdoor tool wall is a great place to repurpose leftover wood you've had lying around. Just make sure the wood will hold up to exposure in the elements. Recycled barn wood or old fence pickets make an inexpensive wall surface and add a touch of rustic homestead flair!

Here are step-by-step instructions for building a freestanding tool wall of your own.

1. **Lay out your wall location to establish post spacing.**

   a. Use a string and wooden stakes to determine the wall's placement. The length of the wall should be dictated by the wood you'll use and how big you want your wall to be. Six to eight feet is adequate for many gardeners. Depending on the location in your yard, you may be able to hang tools on both sides of your wall, doubling your storage capacity!

   b. Mark the stakes' location on the ground; this is where you'll sink the end posts.

2. **Dig post holes and anchor the posts in the ground.**

   Basic 4 x 4 posts should be sufficient to support your wall. Make sure you use outdoor-approved lumber.

   a. Dig holes for each post that are two to three times wider than the posts themselves. Dig to a depth that is ⅓ the post height plus 6 inches. For example, if you want to end up with 6-foot posts (and the same height wall), dig holes that are 30 inches deep and have posts that measure 8½ feet.

   b. Fill the bottom 6 inches of the hole with gravel.

   c. Set your posts on the gravel and use temporary braces to hold them plumb.

   d. Use the string to make sure the fronts of the posts line up. (If the string makes good contact with the faces of the posts, the boards that comprise your wall will, too, for easy installation.)

   e. With the posts' orientation set and braces, backfill the holes with concrete.

3. **Fasten wall boards between the posts.**

   a. After the concrete has hardened and set, remove the post braces and attach wall boards to the posts. It's usually easiest to start at the bottom and work your way up. Make sure the first board you attach is level, and they should stay level as you add more.

   b. Leave a gap at the bottom of the wall (you can't hang anything that low anyway) and don't go higher than you can comfortably reach.

   c. Repeat on the other side of the posts if you're building a double-sided tool wall.

4. **Add blocking between the wall surfaces.**

   For added support, sandwich a few lengths of lumber between the two wall surfaces and fasten them through both sides of the wall boards. This will increase the wall's strength and keep it from bowing outward once you start hanging tools.

5. **Hang your tools.**

   Test-fit tools against the wall to see how each one should best hang. Try different positions, placements, and configurations to maximize space. Use nails, screws, screw-in hooks, or a combination to accommodate all the tools you want to hang.

TIP

Check hardware stores and home improvement centers for a huge array of hooks and hangers. Most often found with garage organization or shelving supplies, you can find hangers specifically designed to safely hold everything from post-hole diggers to wheelbarrows on a wall!

Creating a Compost Bin (or Two)

When it comes to compost, you don't necessarily need to enclose it at all. After all, composting occurs when organic matter is piled in a heap and left to rot (as described in Book 1, Chapter 5), so obviously the decomposer organisms don't care if a high-rise condo surrounds their food supply. However, in the interest of keeping your homestead as tidy as possible, you may decide to organize your composting area with some type of structure.

This section gives you two options for creating your own compost bin.

Using wood shipping pallets

Because composting is all about recycling organic matter, it seems appropriate for composting bins to be made from recycled materials as well. Wood shipping pallets are used as platforms to support consumer goods being transported by forklifts and other equipment. Recycled pallets are a fantastic option for creating easy-to-build and highly effective composting systems, especially when you have a lot of organic matter to process.

They're easy to come by, piled at construction sites or stacked at loading docks behind businesses and warehouses, awaiting recycling or disposal. Explain to the head honcho you'd like to recycle some to make a compost bin. Most places pay to have them hauled away and are happy to oblige.

WARNING

Pallets can be heavy, weighing up to 50 pounds apiece. Make sure you can manage moving them around yourself, or enlist an extra set of hands. And make sure you select pallets that are in sound structural shape. They can get beat up by forklifts and heavy equipment; you'll be able to identify a pallet that's falling apart with just a quick once-over.

One person can assemble a shipping pallet compost bin, although it goes smoother with two: one to hold the pallets upright and steady while the other ties them together. Follow these steps to erect the bin shown in Figure 1-7:

1. **Level the ground where your bin will be.**
2. **Set the pallets upright in a box shape.**
3. **Lash the pallets securely together at the corners with wire or rope ties.**

   The front pallet acts as a hinged door, allowing you to access your compost by undoing the ties on one side and swinging it open. You can also remove the entire pallet to have wider access when adding or turning organic matter.

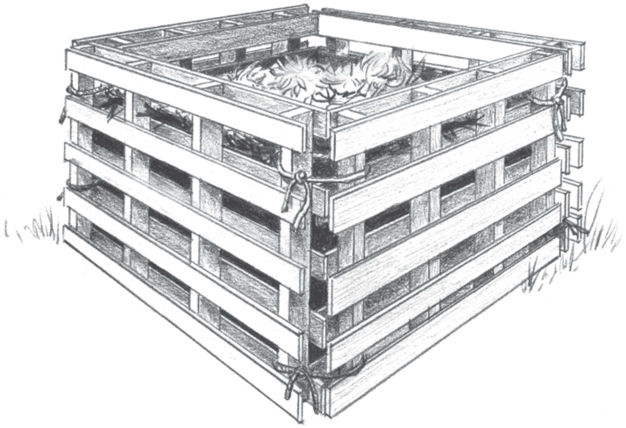


FIGURE 1-7: Shipping pallet compost bin.

TIP

Add second and third bins to your first shipping pallet bin using common side walls. You need three pallets for each additional bin.

Wood and wire three-bin composter

A stationary wood and wire three-bin system, shown in Figure 1-8, offers a variety of advantages, including the ability to compost large amounts of yard materials in little time. Wire mesh sides or bottoms or both keep pests out of the bin while allowing the aeration needed for decomposition, and the wood construction blends unobtrusively for a natural appearance in your landscape.

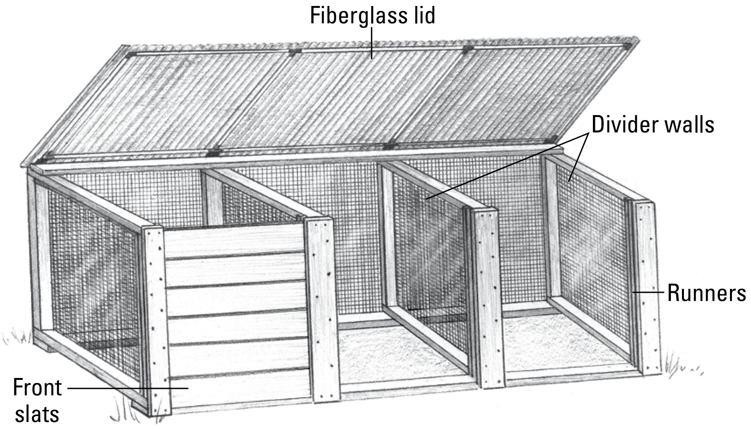


FIGURE 1-8: A wood and wire three-bin system with a fiberglass lid.

You can also fabricate pest-proof hinged lids from wood and wire or fiberglass. (A fiberglass lid maintains moisture within the pile or keeps out excessive rain or snow, depending on your conditions.)

WARNING

Building this bin style yourself requires more carpentry skills and tools than other projects in this chapter, and the materials are more expensive than other home-built styles. You can build this unit for approximately $300 to $375.

This bin design and construction project is courtesy of Seattle Public Utilities. The overall outside dimension of the finished project is 9 feet wide x 3 feet deep x 32 inches high; each bin section measures 35½ inches wide x 3 feet deep x 32 inches high. You can downsize the design to a one- or two-bin system if that's all the space you require. For instructions for building other types of composting bins, visit `www.seattletilth.org`, or use your favorite Internet search engine to find instructions for other designs.

Materials

The list of materials and tools needed to construct the three-bin composter is lengthy, but you should be able to find everything you need at a home improvement store:

Quantity	Item
2	18′ lengths of 2″x4″ cedar
4	12′ lengths (or 8 6′ lengths) of 2″x4″ cedar
1	9′ lengths of 2″x2″ pine lumber
2	6′ lengths of 2″x2″ pine lumber
1	16′ length of 2″x6″ cedar
9	6′ lengths of 1″x6″ cedar
22′	½-inch hardware cloth, 36″ wide
12	½-inch carriage bolts, 4″ long
12	Washers and nuts for bolts
3 lbs	16d galvanized nails
½ lb	8d galvanized casement nails
250	Poultry wire staples or power stapler
12′	Sheet of 4-oz clear corrugated fiberglass
8′	Sheet of 4-oz clear corrugated fiberglass

Quantity	Item
3	8′ lengths of wiggle molding
40	Gasketed aluminum nails
2	3″ zinc-plated hinges
8	Flat 4-corner braces with screws
4	Flat 3″ T-braces with screws

Instructions

The following steps walk you through building the three-bin composter, starting with the dividers and finishing with the fiberglass lid.

1. **Cut two 31½-inch and two 36-inch pieces from each 12-foot 2 x 4.**
2. **Butt end nail the four pieces into a 35-x-36-inch divider section (see Figure 1-9). Check to make sure each divider section is square.**

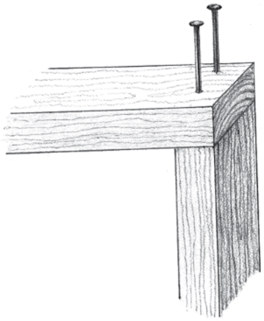


FIGURE 1-9: Align corners to butt end nail them together.

3. **Repeat Step 2 for the other three divider sections.**
4. **Cut four 37-inch-long sections of hardware cloth and bend back the edges 1 inch. Stretch across each divider frame, check for squareness of the frame, and staple the screen tightly into place every 4 inches around the edge.**
5. **Set the dividers up parallel to one another 3 feet apart.**
6. **Measure and mark the centers of the two inside dividers.**
7. **Cut four 9-foot pieces out of the two 18-foot 2 x 4 boards.**
8. **Place two 9-foot base boards on top of the dividers and measure the positions for the two inside dividers.**

9. **Mark a centerline for each divider on the 9-foot 2 x 4. With each divider, line up the centerlines and make the baseboard flush against the outer edge of the divider.**
10. **Drill a ½-inch hole through each junction centered 1-inch in from the inside edge. Secure baseboards with carriage bolts, but don't tighten them yet.**
11. **Turn the unit right side up and repeat Steps 9 and 10 for the top 9-foot board.**
12. **Using the carpenter's square or measuring between opposing corners, make sure the bin is square, and tighten all bolts securely.**
13. **Fasten a 9-foot-long piece of hardware cloth securely to the backside of the bin with staples every 4 inches around the frame.**
14. **Cut four 36-inch long 2 x 6s for front slat runners.**
15. **Cut two of the boards from Step 14 lengthwise to 4¾-inches wide and nail them securely to the front of the two outside dividers and baseboard, making them flush on the top and outside edges.**

    Save the remainder of the rip cut boards from this step for use as back runners.
16. **Center the remaining 36-inch, full-width 2 x 6 boards on the front of the inside dividers flush with the top edge, and nail securely.**
17. **To create back runners, cut the remaining 2 x 6 into a 34-inch long piece and then rip cut it into four equal pieces, 1¼ x 2 inches. Nail the back runner parallel to the front runners on the side of each divider, leaving a 1-inch gap for slats.**
18. **Cut all the 1 x 6-inch cedar boards into slats 31¼ inches long.**
19. **Use the last 9-foot 2 x 4 for the back of the lid. Cut four 32½-inch 2 x 2s and one 9-foot 2 x 2 from it.**
20. **Lay the pieces from Step 19 on the ground in a rectangle and make sure they're square. Screw in corner braces and T-braces on the bottom side of the frame.**
21. **Center the lid frame from Step 20 on the bin structure, brace side down, and attach it to the bin with the hinges.**
22. **Cut wiggle board to fit the front and back 9-foot sections of the lid frame.**
23. **Pre-drill the wiggle board with a ⅛-inch drill bit, and nail it to the frame with 8d casement nails.**
24. **Cut the fiberglass to fit flush with the front and back edges of the frame.**

25. **Overlay the fiberglass pieces at least one channel wide. Pre-drill the fiberglass and wiggle board for each nail hole.**

26. **Nail the fiberglass and wiggle board to the lid frame, nailing on top of every third corrugated hump with gasketed nails.**

Whipping Up a Walk-In Hoop House

As explained in Book 1, Chapter 7, a hoop house (see Figure 1-10) is a great way to extend your growing season. Although some hoop houses are built just large enough to enclose a row of plants, you can construct a walk-in version that puts several hundred square feet of your garden in a weather-protected, solar-heated environment. And all it takes is some plastic sheeting stretched over a PVC skeleton, and a little homesteader resourcefulness.

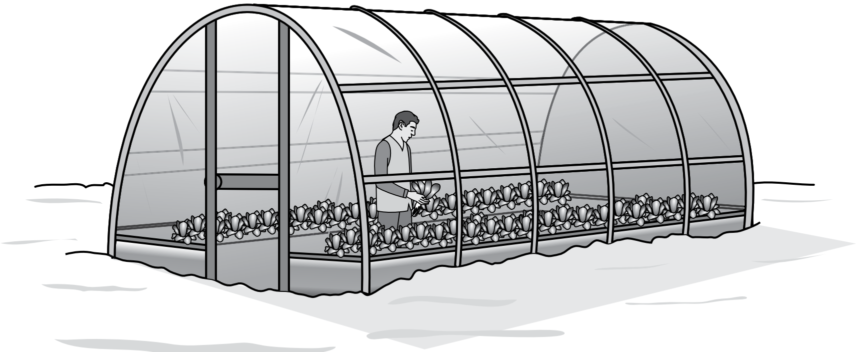


FIGURE 1-10: A walk-in hoop house.

You can scale your hoop house's size as needed, but using 25-foot-wide polyethylene plastic and 20-foot lengths of PVC pipe (both readily available in home improvement stores) creates a hoop house that's 6 feet tall in the center and 12 feet wide — plenty of space for getting veggies off to a great start even in the dead of winter.

White PVC pipe is most commonly found in the plumbing department of your hardware store or home improvement center. Many hoop houses are made from 1½ inch diameter pipe. Smaller diameters may not provide enough strength, while larger diameters cold prove less flexible and harder to build with.

REMEMBER

Plumbing PVC will gradually break down the longer it is exposed to sunlight, though it could take a decade or more to notice any weakness in your hoop house skeleton. Some builders prefer grey electrical PVC conduit, which is usually flared at one end so that sections can be joined together without separate connector pieces. Galvanized steel pipe can be used for a super-sturdy hoop house where extreme winds and heavy snow load are a concern, but bending it is a challenging job some DIYers aren't interested in. You may find that curved lengths of pipe can come in handy on the homestead; look for a specially designed bending tool at home improvement centers or online from vendors such as `www.johnnyseeds.com`.

Similarly, most backyard hoophouses use ordinary plastic sheeting, sold in rolls of a hundred feet or more. Greenhouse plastic sheeting is available, too: it's specially formulated for UV exposure and is more tear-resistant than the polyethylene sold in your hardware store's paint department. You may choose to start simple with your first hoop house and upgrade materials down the road. But many gardeners consider a hoop house to be something they build on the cheap, meant to last one year. They simply build another one the next year.

Here are the steps for constructing your own walk-in hoop house. You might want to make some modifications to better suit your space or needs:

1. **Start by building a ground frame.**

   A four-sided ground frame made of outdoor-approved lumber gives your hoop house a base to anchor to. Some gardeners choose to build a hoop house over existing raised beds, and use the beds themselves as the frame.

2. **Drive anchors for the hoop pipes.**

   Short lengths of steel rebar (used to reinforce concrete) are a popular choice. Pound one piece into the ground at each corner of the frame, leaving 12 inches exposed above grade. Drive another rebar anchor every three feet along the length of the ground frame.

3. **Erect the PVC ribs of the hoop house.**

   Slide one end of the PVC pipe over one rebar anchor. Bend the pipe and slip the other end over the anchor on the opposing side of the ground frame. Where the PVC meets the ground frame, it's a good idea to use a few screws to fasten the pipe directly to the lumber to lock it in place.

   WARNING

   Have a helper when working with long pieces of PVC. Both ends of the pipe must be held securely while it's being bent and positioned over the anchors to keep it from snapping back and being a danger.

TIP

If 20-foot lengths of PVC are not available (or prove to be too cumbersome to transport and work with), you can use shorter lengths of pipe. You'll just need to include the appropriate couplers to connect them to one another to create the desired overall length.

4. **Install side supports.**

   The PVC ribs need extra support to keep the structure rigid. Purlins are horizontal supports that help hold the PVC skeleton together. Basic 2 x 4 lumber works well for this purpose. One purlin should be installed at the top of the arch, one set a few feet off the ground on either side wall, and one more set halfway between. All purlins should run the entire length of the hoop house (on the inside of the pipes) and be fastened directly to the ribs with long screws or bolts, drilling through the PVC and the lumber.

   TIP

   In some parts of the country where wind and snow are not an issue, lightweight purlins made from more PVC are adequate. These PVC purlins can be lashed to the ribs with heavy baling wire or nylon zip ties.

5. **Put on the plastic.**

   With at least one helper (and probably some ladders), unroll the plastic sheeting and slip it over the PVC skeleton. Pull and adjust the plastic as needed, making sure there is excess along the ground frame on each long side.

   You can dig a trench and bury the bottom of the plastic to secure it. Some hoop house owners wrap the excess around lumber strips and fasten these strips to the ground frame to keep everything tight. Some use rope to tie the loose ends of the plastic down. Some fasten a second set of purlins on top of the first, sandwiching the plastic in between. This holds the plastic in place but allows the ends to be kept loose, in case you might want to roll up the walls of your hoop house as needed for ventilation and temperature control. In many locations, roll-up sides are a necessity to keep the hoop house interior from overheating.

6. **Enclose the ends.**

Now you have a tunnel. To make it a hoop house, you need to enclose the ends. Most owners construct a simple lumber frame at one end and anchor it to the ground frame, purlins, and ribs. Then they stretch the plastic over the frame before attaching it permanently.

The other end opening also gets a wood frame that's clad in polyethylene, but don't forget to include a door! You can make the door from scratch using the same 2 x 4 lumber as the frames; make it wide enough for you to get in and out comfortably (presumably while carrying gardening tools or trays of seedlings). Attach it to the frame with door or gate hinges and cover it with its own piece of plastic sheeting.

IN THIS CHAPTER

- **Selecting the best building materials for your homemade hive**
- **Constructing your own Kenya top bar hive**

Chapter 2

Building a Backyard Beehive

Homesteading beekeepers are an especially self-reliant lot. They're quick to find practical ways to care for their bees and discover innovative, cost-effective solutions to beekeeping problems. Typically, beekeepers are passionate about nature and the well-being of the environment. So it's no wonder that more and more beekeepers are finding out how to build their own beehives and equipment. Sure, you can purchase kits from beekeeping supply vendors, but doing it yourself is very enjoyable and satisfying. You may even save some money!

In today's green world of self-sufficiency, sustainability, and back-to-basics mentality, why not roll up your sleeves and make a beeline for a little side hobby that both you and your bees will appreciate and benefit from?

Whether you're a new beekeeper or a seasoned old-timer, this chapter provides you with a step-by-step approach for building one of the most cost-effective and popular hive styles. And don't fret if you don't know much about carpentry or woodworking — the instructions are simple and straightforward.

Choosing Materials

Beehives, including all the ones in this book, are typically made from wood. You have hundreds of kinds of wood to choose from. But from a practical and financial viewpoint, you should limit your "discovery" to wood that is readily available from most lumberyards and home improvement centers. Some woods are cost-effective (cheap), and some are exotic (expensive). In the following sections, a few options for your lumber are presented.

The best woods for beehives

A handful of woods are used most frequently for making beehives. Sometimes the choice is regional (selecting a wood that's readily available in your area), sometimes the choice is financial (selecting a wood because it's the lowest price), and sometimes the choice is based on durability (selecting a wood because it stands up to the elements better than other woods). What follows are the woods most frequently used by the commercial manufacturers of beekeeping equipment:

- **Pine:** Hands down, pine is the most widely used choice. It is readily available everywhere, among the least expensive lumber to purchase, and easy to work with. Note that there are different grades of pine. Two are of interest here:
  - **Knotty (sometimes referred to as *standard* pine):** The knotty grade of pine is the least expensive and is perfectly sound for building, but it does contain knots and some other cosmetic imperfections. If you can live with a more rustic-looking hive, by all means go for the standard grade and save a few bucks. You may need to order a little more material than stated in the plans, because the knots sometimes fall right where you plan a critical piece of joinery. So having a little extra material allows you to choose an alternate piece of wood without the offending knot.
  - **Clear (sometimes referred to as *select* or *premium* pine):** The clear grade is pricier. As the name suggests, this grade is clear of knots and other blemishes. The grain of the wood also tends to be tighter and straighter. It makes for a very nice looking, defect-free hive.

  TIP

  Pine isn't the most durable wood to weather the elements, so you must protect pine with some coats of outdoor-quality paint, exterior polyurethane, or marine varnish. (See the later section "Protecting Your Hive with Paint and More" for details.)

- **Cypress:** The cypress tree produces a sap-type oil that preserves the wood and naturally repels insects and mold. So cypress is a terrific wood for making beehives and beekeeping equipment. But with most of the wood coming from southern states in the United States, it's not readily available all across the country. But if you can get your hands on some cypress, you won't be disappointed in the results. It's a beautiful and naturally durable wood for building beehives.

- **Cedar:** Cedar is a beautiful wood, and it smells divine. The natural oils make it less prone to warping, less susceptible to bug infiltration, and less likely to rot than other woods. Though you can paint it, you certainly don't have to because of its naturally durable qualities. Left untreated it will weather to a lovely, light gray patina. Many varieties of cedar exist, and depending on where you live, cedar lumber can sometimes be tricky to find. It's also more expensive than pine. Western red cedar is the most widely available type across the United States.
- **Spruce and fir:** Pine, spruce, and fir trees are all conifer trees. But when it comes to nomenclature in the lumberyard, spruce and fir are typically associated with *stud* lumber (versus *board* lumber). The plans in the book make use of spruce or fir studs (either spruce or fir is fine, as they're interchangeable) that you use for making frames, top bars, and some other applications.

WARNING

You'll likely want to steer clear of pressure-treated wood to avoid exposing your bees to chemicals. Although since 2004, this category of wood product no longer uses toxic copper, chromium, and arsenic (CCA) to protect it from insects and mold. The new recipe is supposed to be safe. But if you're going to the effort to construct your own beehive, why take a chance? Stick to all-natural, untreated wood and rest easy.

Sizing up lumber

Most everyone has heard of a *two-by-four.* It's the lumber used to frame a house. And that's how you'd order it at the lumberyard: "I need a two-by-four." But did you know that it doesn't measure 2 inches by 4 inches? It actually measures 1½ inches by 3½ inches. However, when the board is first rough-sawn from the log, it *is* a true 2x4. By the time it's dried and planed, it becomes the finished 1½ inch by 3½ inch size.

REMEMBER

Nominal dimensions refer to lumber *before* it's dried and planed to size at a lumber mill. You use nominal dimensions when you order wood. *Dimensional lumber* is the product that leaves the mill *after* drying and planing. These are the actual dimensions that you have to work with. For the plans included here, the materials list refer to the nominal dimensions (how you order your materials), and the cut lists refer to the actual dimensional size (what you have to work with).

Table 2-1 lists the nominal and dimensional measurements for various sizes of lumber.

TABLE 2-1

Nominal Dimensions versus Actual Dimensions

Nominal Dimensions	Dimensional Lumber Size
5⁄4 x 6 (decking)	1″ x 5½″
1 x 3	¾″ x 2½″
1 x 4	¾″ x 3½″
1 x 5	¾″ x 4½″
1 x 6	¾″ x 5½″
1 x 8	¾″ x 7½″
1 x 10	¾″ x 9½″
1 x 12	¾″ x 11½″
5⁄4 x 3	1″ x 2½″
2 x 3	1½″ x 2½″
2 x 4	1½″ x 3½″
2 x 6	1½″ x 5½″
4 x 4	3½″ x 3½″

Getting the scoop on plywood

Many kinds of plywood are available. True plywood is made up of multiple thin layers of laminated wood veneers, each oriented at a 90-degree angle to the previous layer. This results in a product that resists warping and is incredibly strong. But note that any plywood meant for *interior* use won't last long in your bee yard. After a few rains or snowstorms, the layers that make up the plywood quickly peel apart like an onion.

For bottom boards that are exposed to weather, use either ¾ inch or ⅜ inch exterior grade plywood. Exterior plywood uses water-resistant glue to adhere its layers together. Don't use anything other than this for exterior applications.

Rifling through roofing materials

The roof of your hive takes the brunt of abuse from sun, rain, snow, and other climatic challenges. The roof (or outer cover) is a critical component for keeping your hive dry and your bees safe from the elements. You can optimize the roof's effectiveness and maximize its durability by adding some form of weatherproofing (just like the roof on your house). Most of the following options are interchangeable with one another. Pick the roofing material that best meets your needs and preferences.

- **Aluminum flashing:** Aluminum flashing makes a good roof material. This is the stuff that's used on the roofs of houses as a moisture barrier. It's easy to cut (with tin snips or even a utility knife) and a breeze to bend and shape. It's also readily available from any home improvement store. Aluminum flashing works well for both flat- and peaked-roof hives.
- **Asphalt roofing shingles:** This option is a little fussier because the application of roofing shingles takes a bit more work than some of these other options. But shingles are very practical and can give your hive a "little house" appearance. Roofing shingles come in a huge selection of colors. They work best on peaked-roof hives. Use a roofing nail that's short enough that it won't go all the way through both the shingles and the wooden hive top (¾ inch should be ample).
- **Cedar shake shingles:** Now we're talking! This option results in a very elegant cottage look. If you're selling your handiwork, this roof treatment would be very attractive to potential buyers. You won't find this kind of stylishness in your typical beekeeping supply catalogue. Roofing shingles work best on peaked-roof hives. Use a roofing nail that's short enough that it won't go all the way through both the shingles and the wooden hive top (¾ inch should be ample).
- **Copper flashing:** This is similar to aluminum flashing, but, as the name indicates, it's made of copper. It's pricey, but it can really dress up a hive if such aesthetics are important to you. Copper weathers to a soft green patina (like the Statue of Liberty). If you're building hives to sell, this extra bit of bling can be attractive to buyers and even command premium prices for your hives. Copper flashing tends to be available in a heavier gauge than aluminum flashing, so it's a little more difficult to cut (tin snips work best) and even trickier to bend. Copper flashing works well for both flat- and peaked-roof hives.
- **Roofing felt paper:** Also called *tar paper,* this material is made of glass fiber infused with tar and asphalt. It makes a very practical but not very elegant roofing material for any beehive. It's easy to cut with heavy duty scissors or a utility knife and can be tacked to the hive's roof using a heavy-duty staple gun (be sure to use stainless steel staples to prevent rusting). It can wear out or tear over time, so you may have to replace it every few years. Felt paper works well for both flat- and peaked-roof hives.

TIP

When purchasing any of these roofing materials, you'll likely wind up with a lot of surplus material (unless you plan to make a number of hives). For example, aluminum flashing is typically sold in a 10-foot roll, and you need only around 2 feet of flashing for the roof of one hive. So rather than purchase more than you need, visit a home construction site and see if the foreman is willing to give you some leftover material to cover the roof on your hive. You don't need that much for one hive. A jar of honey may just be the perfect barter for a couple of feet of flashing or a few dozen roof shingles!

Selecting screening materials

Some hive designs call for screening material designed to keep the bees contained in a given area. But this isn't your ordinary window screening material (that stuff is too fine, and the bees would surely clog it up with propolis). Instead, the screening material of choice for beekeeping is *hardware cloth*, which consists of wire that's woven and welded into a grid.

Specifically, you need hardware cloth with ⅛-inch square openings. It's known as #8 hardware cloth. It typically comes in 3-foot-by-10-foot rolls. If your local hardware store doesn't have #8 hardware cloth (they likely won't), you can easily find it online. Some beekeeping supply stores are now selling it by the foot (see `www.bee-commerce.com` or `www.brushymountainbeefarm.com`). You can cut hardware cloth to size using tin snips or even a pair of extra-heavy-duty.

Protecting Your Hive with Paint and More

After you build your masterpiece, you'll want to protect it from the elements. After all, most of this beekeeping stuff is intended to be kept outdoors year-round, where rain, sleet, and the gloom of night can take their toll. It's recommended that you apply some kind of protection to all exterior wooden surfaces. Protecting your woodenware with exterior grade paint, weatherproof polyurethane, or marine varnish not only looks nice but also adds many seasons of life to your wooden beehives and equipment.

Here are some options for protecting the exterior of hives:

- **Most beekeepers paint their hives using a good quality exterior paint.** Either latex or oil-based paints are fine. Semi-gloss paints are generally easier to keep clean than matte. As to color, it really doesn't matter — it's up to you. White is the most traditional color in the United States, but in other countries, the sky's the limit. Like your house, you'll need to repaint the hive every few years if you want it looking fresh.

WARNING

Keep in mind that really dark colors heat up more than light colors. Dark hives may be fine in the cold winter but can quickly overheat the colony in the dog days of summer. So avoid black, navy blue, and aubergine!

- **Another approach is to polyurethane your woodenware.** You can even stain the wood first if you want to. This is an attractive, natural-looking alternative to paint. In fact, this approach not only protects the wood but also tends to blend in better with the environment (which can be helpful if you don't want to draw attention to your hives). Be sure to use exterior grade polyurethane; gloss, semigloss, or satin is fine. Oil-based polyurethanes tend to stand up better to the elements. The resulting finish isn't very flexible and may crack over time and require touch-ups.
- **Alternatively, you can apply several coats of marine-grade (spar) varnish to your woodenware.** Again, you could stain the wood first if you want to. Spar varnish is slower drying but more flexible than polyurethane. Its flexibility means it tends not to crack. However, it must be reapplied periodically as it does tend to chip and flake off over time.

REMEMBER

All the interior parts of the hive are best left *untreated* — no paint, no stain, no polyurethane, and no varnish. Keep the interior (where the bees live) au naturel. Doing so is healthier for the bees, and the bees prefer the natural living conditions because they're more like the inside of a tree, where bees live in nature.

Your hives and accessories undergo a good deal of stress over the seasons from weather conditions and from you frequently opening and closing the hives, moving the hives, swapping hive bodies, harvesting honey, and on and on. The goal is to build strong assemblies that stand the test of time. You can take a little extra step to ensure the wooden parts hold together for a long, long time. Use a good-quality, weatherproof wood glue in addition to nail and screw fasteners. Although gluing isn't absolutely necessary, your joinery will have a better chance of long-term survival if you take the time to apply a thin coat of weatherproof wood glue before screwing or nailing wooden parts together.

Building the Kenya Top Bar Hive

The top bar hive is likely one of the world's oldest beehive designs, going back centuries. In recent years, this simple, practical design has seen a resurgence among backyard beekeepers, particularly because more and more backyard beekeepers are seeking more natural beekeeping options. Top bar hives are used extensively throughout Africa and in other developing countries where building materials are scarce. The design in this chapter is called a Kenya top bar hive; its sloped sides tend to result in stronger combs and to discourage the bees from attaching the comb to the bottom of the hive.

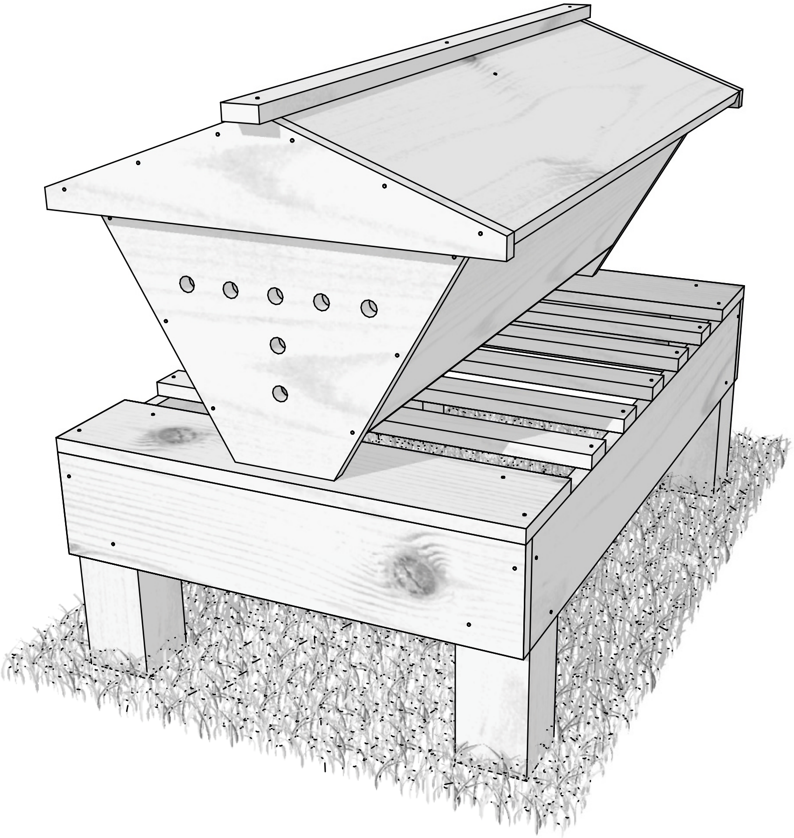


Illustration by Felix Freudzon, Freudzon Design

The Kenya top bar hive has many design variations, but they all consist of a long, horizontal hive body with sloped sides, top bars (instead of frames), and a roof. The design in this chapter was developed by beekeeper Mike Paoletto. It's a very practical and functional hive, but like all top bar hives, it has some pros and cons. First the pros:

- The top bars (which, unlike frames, have no bottom or side rails and use no full sheets of foundation) allow the bees to build their comb freestyle and without restrictions on cell size.
- The design provides a living arrangement that's similar to how bees live in the wild (within the hollow of a tree). As a result, the bees tend to be less stressed and thus less prone to disease.

- The hive is relatively easy and inexpensive to build.
- You don't need a honey extractor, as you typically cut the comb from the hive and crush it to extract the honey. Alternatively, you can harvest chunks of natural comb honey.
- The hive requires less heavy lifting than a conventional, Western-style hive, which requires you to remove and manipulate supers and hive bodies.
- You don't need to store empty honey supers during the winter months because this design has no supers.
- The hive yields lots of beeswax because you remove most of the comb during the honey harvest. You can then use the wax for making candles, cosmetics, and furniture polish.

WARNING

However, the Kenya top bar hive also has some cons:

- To harvest the honey, you must destroy the comb. On the other hand, that means that every year, the colony uses a fresh supply of beeswax comb, so chances of a pesticide buildup are less than in wax that's used over and over.
- Compared to supermarket honey, the honey you harvest may contain a high percentage of pollen and be cloudy in appearance. But one could argue that this honey is far more natural than the ultra-filtered and pasteurized commercial honey found in many stores. And the pollen content provides the honey with extra protein.
- Moving the fragile top bars in the hive and doing various beekeeping manipulations are difficult or even impossible compared to what's possible with a hive using Langstroth-style frames (which support the comb on all four sides). But the whole idea of this design is to provide as natural an environment as possible for your bees with fewer interruptions from the beekeeper. Those manipulations are contrary to the all-natural objective.
- Administering medications to your bees can be difficult (the hive doesn't have a feeder, for example). But hey, a top bar hive is all about a sustainable, more natural approach to beekeeping. So medication and chemicals need not apply. Bees tend to be healthier when under less stress and in a more natural environment, and this simple design provides just that.
- This type of hive has the potential of lower honey production because it has a fixed number of top bars versus more modern designs, where multiple honey supers and frames can be stacked endlessly, one on top of the other.
- Combs are much more fragile than those built in a Western-style frame (such as a Langstroth hive; see Book 4, Chapter 1). You need to be very careful when inspecting combs of a top bar hive.

Vital stats

Here's an at-a-glance look at the Kenya top bar hive, to help you decide whether it's the best type for you to build for your backyard:

- **Size:** 38 inches x 24 inches x 31¼ inches.
- **Capacity:** You can't add supers or additional hive bodies. The space is fixed and thus limited.
- **Type of frame:** This design uses a top bar, not a frame. It doesn't have side bars, a bottom bar, or full sheets of beeswax foundation to deal with (nor the costs associated with these elements). The bees build their comb naturally and without restriction onto each of the top bars placed in the hive (28 in all).
- **Universality:** All the gadgets and add-ons that you might use with a conventional Langstroth hive (feeders, queen excluders, frames, foundation, and honey-extracting equipment) are irrelevant to the Kenya top bar hive. Its design is virtually all-inclusive and requires no extras. And with no standardization of design, commercial replacement parts for top bar hives aren't available.
- **Degree of difficulty:** This is likely one of the easiest hives to build. It has no complex joinery and requires no complicated frame building or foundation insertion. That's why this design has remained so popular in Africa and other developing countries.
- **Cost:** Using scrap wood (if you can find some) would keep material costs of this design very minimal, but even if you purchase the recommended knotty pine, hardware, and fasteners, you can likely build this hive (including the top bars and the stand) for around $120.

Materials list

The following table lists what you'll use to build your Kenya hive and the top bars used with it. In most cases, you can make substitutions as needed or desired.

Quantity	Lumber	Hardware	Fasteners
2	8' lengths of 1" x 6" clear pine lumber	Weatherproof wood glue	20 #6 x 2½" deck screws, galvanized, #2 Phillips drive, flat-head with coarse thread and sharp point

Quantity	Lumber	Hardware	Fasteners
1	8′ length of 1″ x 12″ knotty pine lumber	⅛″ hardware cloth (you'll need a piece that measures 36½″ x 7¾″); #8 hardware cloth typically comes in a 3′ x 10′ roll, but some commercial beekeeping supply vendors sell it by the foot	80 #6 x 1⅜″ galvanized deck screws with coarse thread and sharp point
1	8′ length of 1″ x 12″ knotty pine lumber	½ pound beeswax (to melt and brush on the frames' starter strips)	25⅜″ staples for use in a heavy-duty staple gun
2	12″ x 36″ x 3⁄32″ balsa wood sheets	Optional: 2 quarts latex or oil exterior paint (white or any light color), exterior polyurethane, or marine varnish	25⅜″ staples for use in a heavy-duty staple gun

TIP

Here are a few notes about the materials for your Kenya top bar hive:

- Because of its simple butt-joinery, knotty pine is perfectly okay for this hive, and it's about the least expensive board lumber out there. But pine isn't the most durable wood; it benefits from a protective coating of paint, varnish, or polyurethane. Alternatively, consider keeping your hive as all-natural as possible by using cedar or cypress. Although these woods are more expensive than knotty pine, they stand up well to weather without paint or protective chemicals.
- You can purchase 3⁄32-inch thick sheets of balsa wood online or from a hobby store. Use a utility knife to cut the balsa wood sheets into the 13⅝ inch x ¾ inch starter strips.

Cut list

The following sections break down the Kenya top bar hive into its individual components and provide instructions on how to cut and build those components.

REMEMBER

Lumber in a store is identified by its *nominal* size, which is its rough dimension before it's trimmed and sanded to its finished size at the lumber mill. The actual finished dimensions are always slightly different from the nominal dimensions. For example, what a lumberyard calls *1 inch x 6 inch lumber* is in fact ¾ inch x 5½ inch, and 4 inch x 4 inch posts are actually 3½ inch x 3½ inch. In the following tables, each Material column lists nominal dimensions, and each Dimensions column lists the actual, final measurements.

TIP

You make a number of special cuts in this chapter, including rabbet cuts and saw kerfs.

A *rabbet* (called a *rebate* in the UK) is a recess cut into the *edge* of a piece of wood. When viewed in cross-section, a rabbet is two-sided and open along the edge of the wood. Think of a rabbet as the letter *L* (see Figure 2-1). Rabbet cuts are sometimes used to join two pieces of wood together, but they're also used to create shelves or ledges (such as the shelf upon which the frames rest).

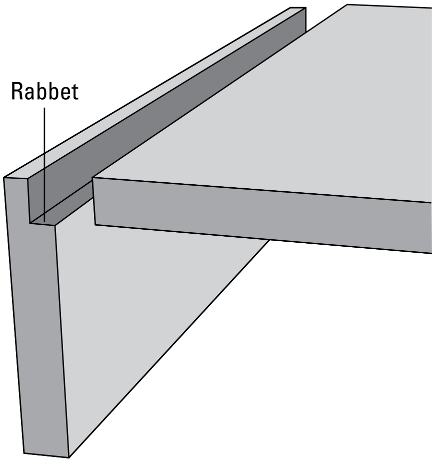


FIGURE 2-1: A rabbet cut is shaped like an L.

A *saw kerf cut* is the incision made by a saw in a piece of wood. The *kerf* is the miniscule amount of wood that's removed by the width of the blade itself (usually around ⅛ inch). When making a kerf cut, you don't cut all the way through the wood. You simply cut a groove or slot that's ⅛ inch wide by the depth specified in the plans.

TIP

You can adjust the height of the elevated hive stand to suit your needs by adjusting the length of the 4-inch-x-4-inch cedar posts. Longer legs result in less bending over during inspections. The 13-inch height of the stand is just right for many beekeepers.

Elevated hive stand

Quantity	Material	Dimensions	Notes
4	4″ x 4″ cedar posts	12½″ x 3½″ x 3½″	These are the leg posts of the stand. Rabbet 5½″ x ¾″ deep along one end of each post (this rabbet accommodates the long sides of the stand).

Quantity	Material	Dimensions	Notes
4	1″ x 6″ clear pine	24″ x 5½″ x ¾″	Two of these are the short sides of the stand and the other two are the wide struts for the top.
2	1″ x 6″ clear pine	36½″ x 5½″ x ¾″	These are the long sides of the stand.
5	1″ x 6″ clear pine	24″ x 2¼″ x ¾″	These are the narrow struts for the top.

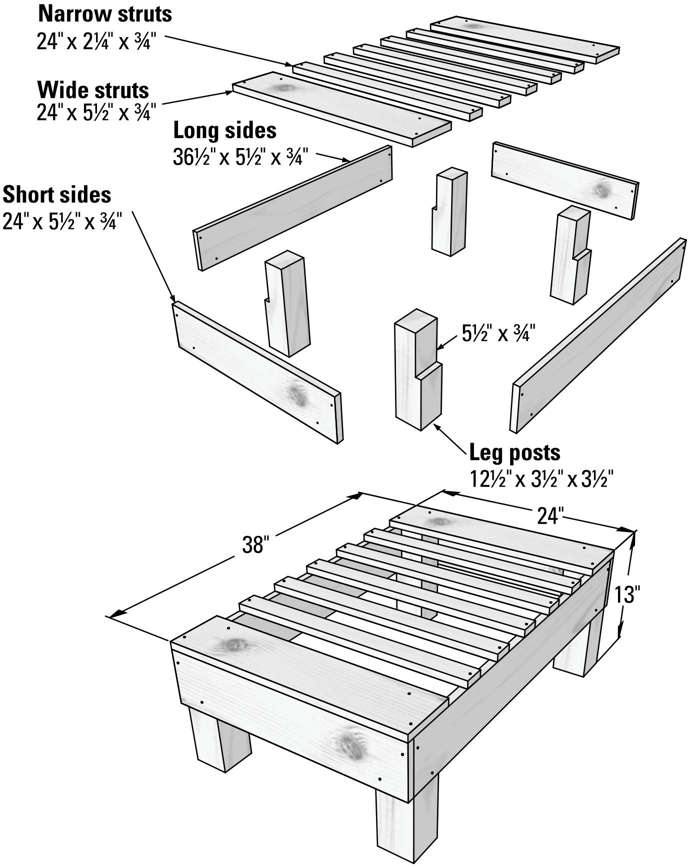

Narrow struts
24" x 2¼" x ¾"
Wide struts
24" x 5½" x ¾"
Long sides
36½" x 5½" x ¾"
Short sides
24" x 5½" x ¾"
5½" x ¾"
Leg posts
12½" x 3½" x 3½"
38"
24"
13"

Illustration by Felix Freudzon, Freudzon Design

Hive body

Quantity	Material	Dimensions	Notes
2	1” x 12” knotty pine	34½” x 10⅜” x ¾”	These are the long sides. Bevel the top long edge so that the outside height measurement of the board is 9” while the inside height measurement remains at 10⅜”. This provides the necessary slope to accommodate the inclined roof boards.
2	1” x 12” knotty pine	18” x 11¼” x ¾”	These are the V-shaped end panels. The top edge is 18” and the bottom edge is 5⅛”. These dimensions are centered, and they’re what determine the V shape of this piece. Drill seven ¾” ventilation/access holes into *one* of the end panels (see the following figures for the approximate placement of the holes).
1	#8 hardware cloth	36½” x 7¾”	This is the screened bottom of the hive. Staple it in place as indicated in the drawing.

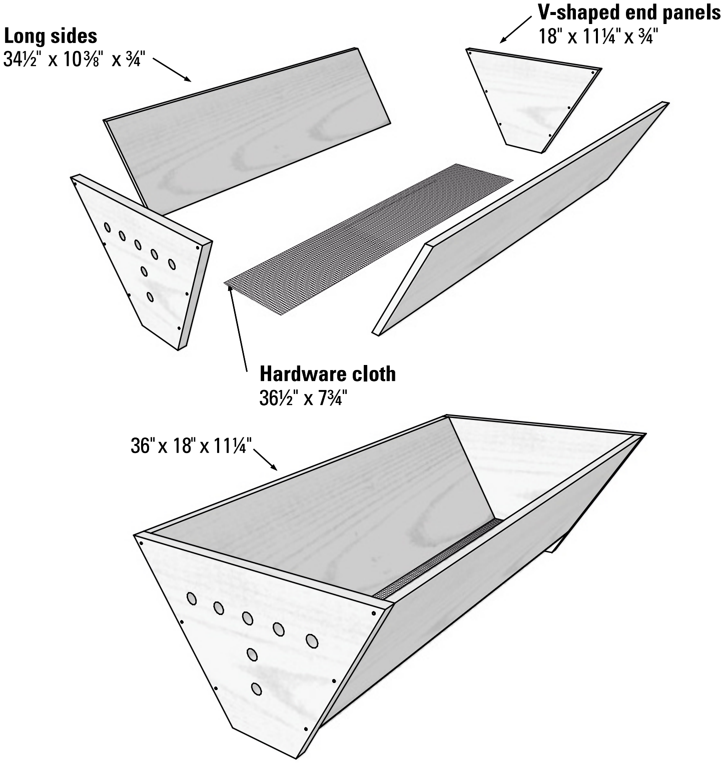

Long sides
34½" x 10⅜" x ¾"
V-shaped end panels
18" x 11¼" x ¾"
Hardware cloth
36½" x 7¾"
36" x 18" x 11¼"

Illustration by Felix Freudzon, Freudzon Design

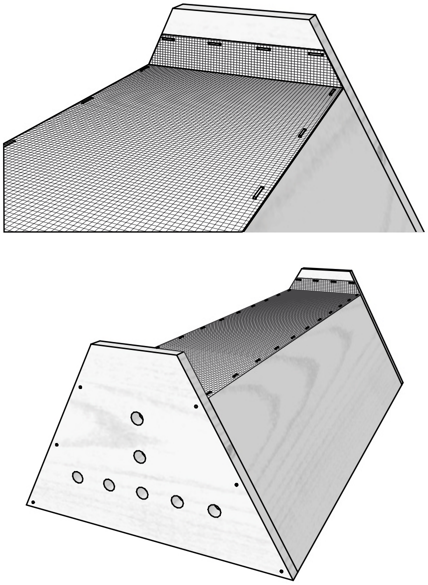


Illustration by Felix Freudzon, Freudzon Design

Top bars

Quantity	Material	Dimensions	Notes
28	1″ x 12″ knotty pine	19⅛″ x 1⁵⁄₁₆″ x ¾″	Cut a saw kerf on one side centered along the entire length, ⅛″ wide by ¼″ deep (you'll glue a starter strip of wood into this groove).
28	³⁄₃₂″ balsa wood	13⅝″ x ¾″ x ³⁄₃₂″	These are the starter strips that you glue into the kerf cut groove.

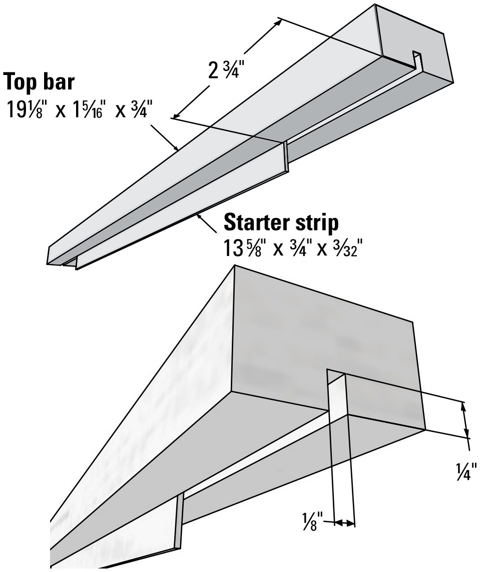
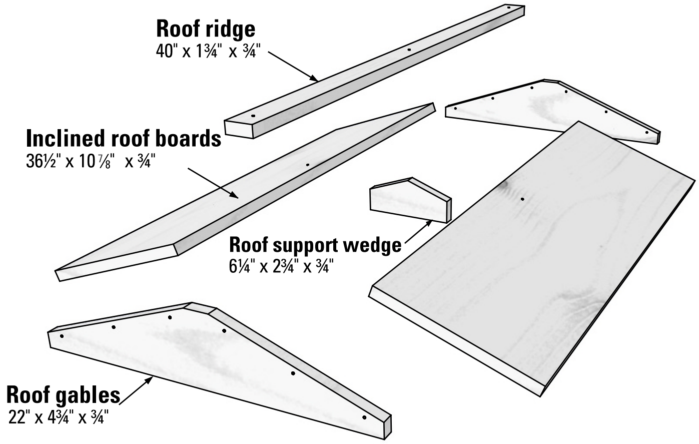

Top bar
19⅛" x 1⁵⁄₁₆" x ¾"
2 ¾"
Starter strip
13⅝" x ¾" x ³⁄₃₂"
¼"
⅛"

Illustration by Felix Freudzon, Freudzon Design

Ventilated roof

Quantity	Material	Dimensions	Notes
2	1” x 12” knotty pine	36½” x 10⅞” x ¾”	These are the inclined roof boards.
2	1” x 12” knotty pine	22” x 4¾” x ¾”	These are the roof gables. Cut into a V shape by leaving a 1” rise at the bottom and a 1⅝” flat cap at the top (see the following figures for details).
1	1” x 12” knotty pine	40” x 1¾” x ¾”	This is the roof ridge.
1	1” x 12” knotty pine	6¼” x 2¾” x ¾”	This is the roof support wedge. Cut into a V shape by leaving a 1⅝” rise at the bottom (see the figures for details).


Roof ridge
40" x 1¾" x ¾"
Inclined roof boards
36½" x 10⅞" x ¾"
Roof support wedge
6¼" x 2¾" x ¾"
Roof gables
22" x 4¾" x ¾"

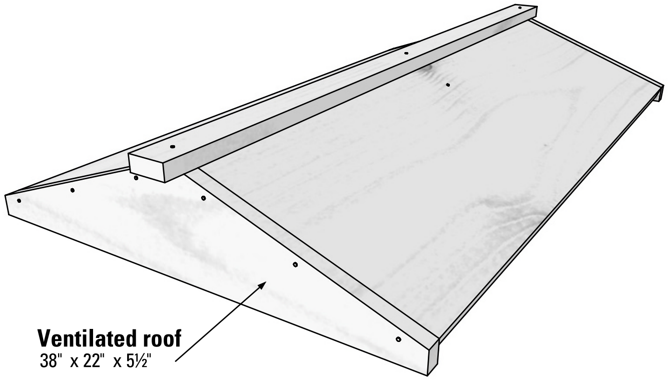
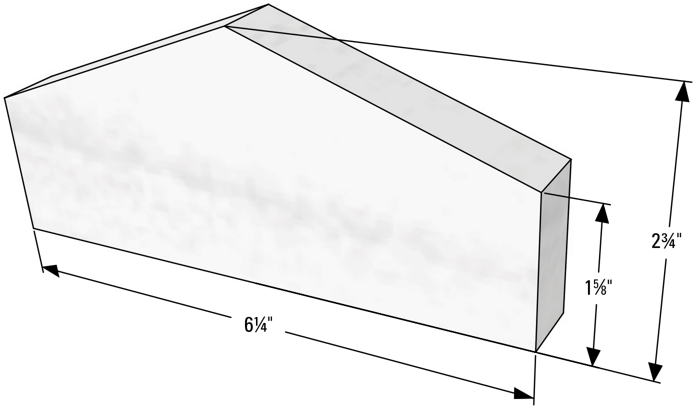

Ventilated roof
38" x 22" x 5½"

Illustration by Felix Freudzon, Freudzon Design



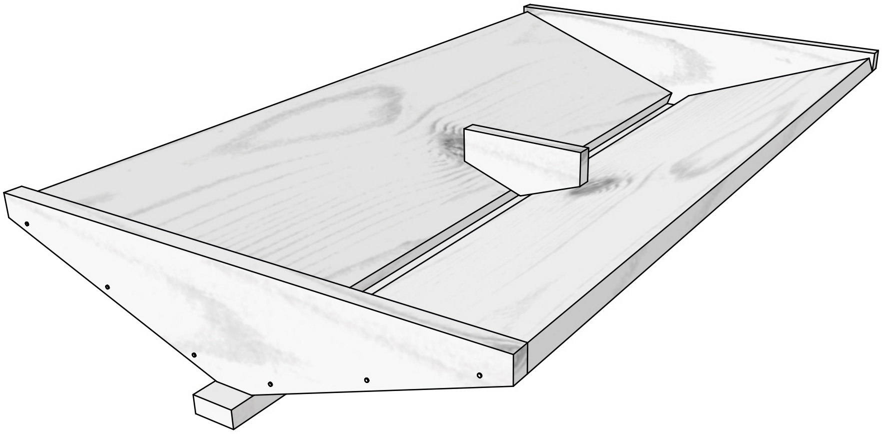


Illustration by Felix Freudzon, Freudzon Design

Assembling the hive

Now the real fun begins — putting all the pieces together to build your hive! You start at the ground and work your way up and up.

TIP

The screws and nails will go in easier if you first drill a $\frac{7}{64}$-inch hole in each spot you plan to place a screw. The pre-drilling also helps prevent the wood from splitting. Do this for all the components you'll be assembling.

TIP

Consider using weatherproof wood glue in addition to the screws. It helps make all the assemblies as strong as possible. Place a thin coat of glue wherever the wooden parts are joined together.

1. **Assemble the hive stand.**

   a. Fasten the long sides into the rabbet cut of the leg posts and secure to each post using two 2½ inch deck screws per post. The edge of the side rail should be flush with the post. Stagger the placement of the screws (as shown in the earlier figure) to prevent splitting the wood.

   b. Using deck screws, attach the two short sides to the leg posts and the long sides. One screw goes into the leg post, and another goes into the edge of the long side rail. Use two screws for each corner.

   c. Attach the two wide struts to the top of the stand. Position each flush with the front and rear ends of the stand. Secure each end of each strut using two deck screws, as shown in the earlier figure.

   d. Attach the five narrow struts to the top of the stand. By eye, evenly space them between the two wide struts and secure them to the top edge of the long sides (use one deck screw at the end of each strut).

   e. Optional: Paint, varnish, or polyurethane the entire hive stand to protect it from the elements. Use two or three coats, letting each coat dry completely before adding the next coat. If you elect to paint the stand, any color will do — it's up to you.

2. **Assemble the hive body.**

   a. Affix the two V-shaped end panels to the long sides using 1⅜ inch deck screws (as shown in the earlier figure). Use a total of six screws on each end panel. Note that the top edges of the end panels and side boards should be flush with each other.

   b. Now turn the hive body upside down and staple the hardware cloth to cover the opening that runs along the entire length of the hive body. Place one ⅜ inch staple every couple of inches. At each end of the screening, bend the screening at a 90-degree angle and staple to the end panels. Trim excess screening as necessary using tin snips.

   c. Optional: Paint the exposed exterior wood of the hive body with a good quality outdoor paint (latex or oil). This greatly extends the life of your woodenware. You can use any color you want, but a light pastel or white is best. With dark colors, the hive builds up lots of heat in the summer, and your bees spend a lot of energy cooling the hive — energy they could be spending collecting nectar. Alternatively, you can use a few protective coats of polyurethane or marine varnish on the exterior wood.

3. **Assemble the top bars.**

   a. You'll assemble a total of 28 top bars. Assembly simply consists of gluing a thin strip of wood into the kerf cut groove. This is the starter strip that gives the bees a starting point to build honey comb on the top bar. For each top bar, center the starter strip into the kerf cut and glue in place using weatherproof wood glue. Let the glue dry before proceeding.

   b. Melt ½ pound of beeswax over low electric heat or in a double boiler. Use a disposable brush to coat the starter strips with a thin coat of beeswax. This further encourages the bees to get started making comb.

   WARNING

   Never melt beeswax using an open flame! Beeswax is highly flammable.

   c. Now place the bars into the hive body. The bars rest on the top edge of the hive body and are butted side by side, like the wooden bars of a marimba.

WARNING

Never paint your top bars because that could be toxic to your bees. Leave all interior parts of any hive unpainted, unvarnished, and all-natural.

4. **Assemble the ventilated roof.**

   a. Affix the two inclined roof boards to the two peaked gables using 1⅜ inch deck screws. The screws go through the peaked gables and into the edges of the roof boards. Use six evenly spaced screws per gable (see the figure for approximate placement; precise spacing isn't critical). Note that there's a 1⅝-inch-wide ventilation opening at the peak of the roof.

   b. Now take the ridge rail and screw it in place using one 1⅜ inch screw at each end. Screws go through the ridge rail and into the flat top of the gable pieces.

   c. Center the roof support wedge in the middle of the ventilation opening (underside of the roof) and secure in place with a 1⅜ inch screw driven through the ridge rail and into the support wedge.

   d. Optional: Paint the exposed exterior wood of the roof assembly with a good quality outdoor paint (latex or oil). You can use any color you want, but a light pastel or white is best. Alternatively, you can use a few protective coats of polyurethane or marine varnish on the exterior wood.

5. **Stack all the pieces together (see the following figure).**

   a. Choose the spot where you want to locate your hive and place the elevated hive stand on the ground. The stand provides the bees with good ventilation, keeps the hive off the damp ground, and raises the colony so it's much easier for you to inspect.

   b. Place the hive body centered on top of the stand. The end of the hive with the holes is the entrance, so be sure the hive is facing in the direction you intend for the bees to fly.

   c. Fill the hive body with the top bars, all 28 of them. The bees will build their beautiful comb on the underside of each top bar along the waxed starter strips. Here they'll raise their brood and store pollen and honey.

   d. Now top everything off with the ventilated roof. It provides your bees with protection from the elements. That's it! You're ready for the bees!

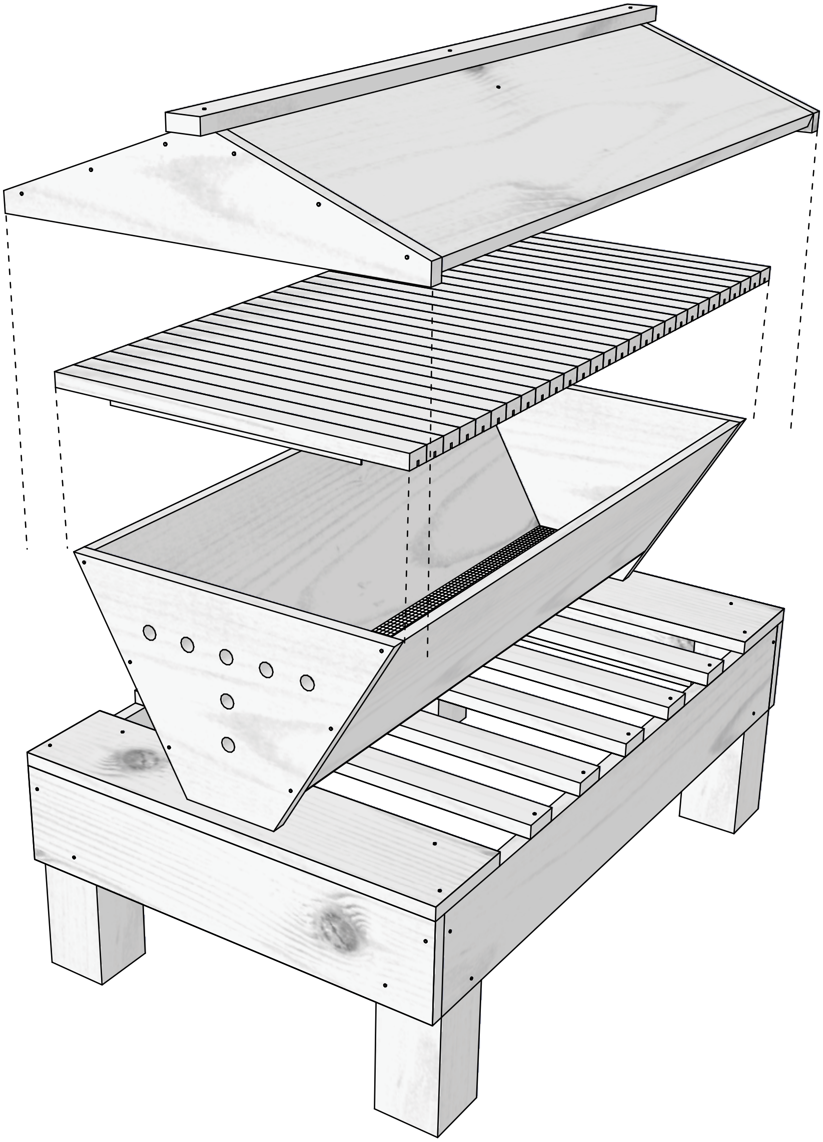


Illustration by Felix Freudzon, Freudzon Design

IN THIS CHAPTER

- **Investigating the best building materials for a chicken coop**
- **Building your own A-frame coop with full plans**

Chapter 3

Building a Chicken Coop

Homesteaders are a particularly self-reliant and improvisational bunch. It's about making do and adapting. Those who raise their own chickens (as discussed in Book 4, Chapters 3 and 4) get paid back in eggs — the equivalent of just a few bucks a month — so the vast majority of caretakers go to great lengths to keep chicken-keeping a low-cost hobby. The whole endeavor is meant to make you just a little more self-sufficient; why spend gobs of cash to do it in the first place?

Now, technically speaking, a chicken owner could let a bunch of hens fend for themselves without a coop. It's *possible,* but it's not *practical.* For almost every one of us, no matter where we live, having some sort of housing is a prerequisite to keeping chickens.

Maybe that helps explain why so many chicken folks build their own coops. Sure, you can purchase a pre-built shelter for your birds (and some awfully nice ones at that), but for many, that goes against the whole reason they got into this to begin with. Why pay for something that you can provide for yourself? And if you're clever enough and self-sufficient enough to see the benefits of raising chickens, you can indeed build your own chicken coop.

Choosing Materials

Your brand-new chicken coop is out there right now: full lengths of lumber, unopened boxes of nails, sealed stacks of shingles, uncut sheets of plywood. They're spread out between the hardware store and the lumberyard, hiding in your own basement or toolshed, or maybe even sitting unused at a neighbor's house. These are the raw materials you'll use. Only they don't know it yet. Maybe you don't either.

Remember, you need to meet just a few requirements when housing chickens. Book 4, Chapter 3 looks at the basic anatomy of a coop — what it *must* have as far as the chickens are concerned.

TIP

By their very nature, chicken-owners are wonderful improvisers who love being self-sufficient and able to adapt to most any circumstance. As a result, chicken coops are often elaborate amalgamations of whatever materials are handy at the time of the build.

Have a stack of old deck lumber taking up space in your garage? Leftover pieces of plywood from a previous project? An unopened stack of shingles from when you had your roof replaced last year? You kept these things for a reason, right? Thinking that maybe someday, you'd find a use for them? Well, welcome to someday.

Using recycled materials is a fabulous way to cut costs on a coop build. Anything you don't have to buy is money you can spend on other things, chicken-related or not. Your flock won't care if its coop window is the annoying one from your living room that you replaced because it was old and outdated. It won't matter to them if their coop is painted with the gallon that you meant to use in the bathroom until you got over your "orange-is-making-a-comeback" phase. Got corrugated roofing panels in two different colors? It's all the same to the chicks. As long as the material in question is sound, there's no reason not to use it. We've seen particularly enterprising chicken owners use wooden pallets as walls. One even turned a junked 1970 Morris Traveller into a fantastically funky coop! Whether you're starting from scratch with all-new materials or recycling some items from a previous project, you have plenty of choices to make.

Boards

You'll find many kinds of lumber at your home supply center. Here's a quick rundown to help you choose the best type for your application:

- **Construction lumber:** Construction lumber is what you'll find the most of at the local lumberyard. It's milled from softwoods (usually meaning pine, fir, or some other evergreen) and has the stereotypical whitish-yellow lumber color.

It's meant for use indoors or where the lumber itself won't be exposed to moisture or weather.

- **Pressure-treated lumber:** Whereas construction lumber is intended for indoor use, green-tinted, pressure-treated lumber is made for outdoor exposure. But contrary to popular belief, the chemicals used to pressure-treat lumber aren't designed to combat moisture. Pressure-treated lumber is all about making wood that will get wet unattractive to pests, fungus, and bacteria that would otherwise converge on it as if it were a dessert bar. Nevertheless, pressure-treated wood is the way to go for lumber that will be exposed to the elements, because it results in a longer-lasting structure.

  Different classifications of pressure-treated lumber exist for boards that will be used above-ground, on-the-ground, or underground. Consult with a sales associate at the lumberyard to make sure you select the lumber that suits your application.

- **Cedar and redwood:** Cedar and redwood offer chemical-free resistance to rot and insects, thanks to their naturally-occurring tannins and oils. They're beautiful woods, but they can also be quite expensive. You may not find all of the same board sizes at your local home improvement warehouse. Although these woods may be a welcome feature for exposed pieces of the coop, using them for hidden framing members or interior structural supports probably isn't money well spent.

- **Other board types:** An increasing number of man-made wood substitutes have made their way to market in recent years. Called *composite woods,* these engineered products (whose brand names include Trex, Veranda, and GeoDeck, among others) are made up of mixtures of resins, regular lumber scrap or sawdust, natural plant material and fibers, and even recycled plastics. From a building perspective, working with them is just like working with real wood. These boards need little to no maintenance and come in a variety of colors. The downsides? This stuff is often prohibitively expensive and can be absurdly heavy. And because it's primarily a decking material, composites often aren't available in regular lumber sizes.

Sheet goods

Much of the wood you'll buy for your coop comes not in board form, but rather in large, thin sheets. These sheet goods cover big expanses quickly and cleanly, often serving as the cladding over a lumber framework, as on a subfloor, a roof, or walls.

- **Plywood:** *Plywood* has become a bit of a catch-all phrase used to describe any type of wood product sold in a flat sheet. But true plywood is made up of several super-thin layers of laminated wood veneer, with new layers added (usually in odd numbers, to prevent warping) during manufacture until the desired thickness is reached (see Figure 3-1). Each layer is oriented at a 90-degree angle to the layers above and below it, giving plywood incredible strength.

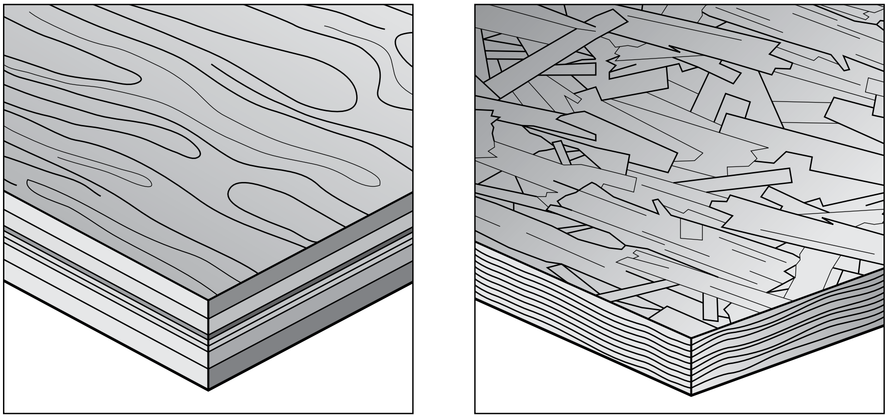


FIGURE 3-1: Popular sheet goods for coop construction include plywood and OSB.

REMEMBER

You'll often see references to plywood thicknesses of ¼ inch, ½ inch, and ¾ inch. But these nice, neat sizes don't actually exist. Once you get to the lumberyard, you'll see that plywood is typically stamped with its *exact* thickness. So what you *call* ¾-inch plywood will *in actuality* measure $^{23}/_{32}$ inch. The former is just easier to say, so don't waste your time searching high and low for plywood that actually measures ¾ inch.

Plywood meant for interior use won't last long in the great outdoors. A few good rains or prolonged exposure to high humidity will peel the layers of interior plywood like an onion. Exterior plywood uses water-resistant glue to adhere its layers together and resist rot.

- **OSB:** Short for *oriented strand board,* this reconstituted product is made of large flakes (or strands) of wood. Like plywood, thin layers are built up and glued together at 90-degree angles to create thickness and provide strength. OSB's low cost when compared to plywood makes it a popular choice as an underlayment or sheathing, where it won't be the finished visible surface. OSB, sometimes also called waferboard, is not considered a good all-weather option for exterior exposure.

REMEMBER

If you're planning to clad the exterior of your coop in some sort of siding, you can afford to be a lot less concerned about whether the sheathing is exterior-grade. Siding (as dealt with later in this chapter) requires some sort of weather barrier between it and the sheathing, so regular plywood or even OSB can be used to cut overall costs.

WARNING

Particle board and medium-density fiberboard (MDF) are widely available sheet goods but not recommended for coop construction, as any sort of water exposure is detrimental.

Flooring

For the vast majority of coops, the flooring of the housing structure is constructed from basic plywood or some other sheet wood. But the wise coop-owner is already thinking ahead, even at this early planning stage, about long-term use, care, and maintenance. That coop you're about to build will be sparkly, shiny, and new only until the moment you let a chicken inside. And that plywood floor you precisely measured, carefully cut, and meticulously fastened into place will quickly become, well, a toilet. So cleaning that floor will become a major concern. Even though you'll almost certainly want to use some type of loose bedding on the floor of your coop, many people like to make the floor itself as easy to clean as possible.

Here are a few popular choices for flooring:

- **Linoleum/vinyl flooring:** Although a wooden sheet material is easy to work with, even exterior-grade plywood isn't meant to be repeatedly and thoroughly hosed down on a regular basis. A layer of cheap linoleum or similar flooring product on top of a solid subfloor can work wonders in making cleanup a breeze. (But you'll still want to throw a layer of soft bedding material on top of it to keep it from becoming a chicken Slip 'n' Slide.)

  TIP

  More than a few coop-owners have fallen in love with a product called Glasbord. A fiberglass-reinforced plastic that comes in panels, Glasbord won't mold, mildew, or rot. It's extraordinarily resistant to moisture, staining, and scratching. It's even lightly pebbled, providing a bit of traction under your flock's feet. You may need to do some searching to find a local distributor, but those who have used Glasbord on a coop floor swear by it.

- **Concrete:** Many people choose to build their coop on an unused corner of a patio and not construct a floor at all. Concrete is a perfectly acceptable floor for a chicken coop. It's easy to clean and can be hosed down without worry.
- **Wire mesh:** Some very small coops have wire floors. (You can find more detail on wire products later in this chapter.) From a maintenance standpoint, this can be a godsend, as chicken waste falls through the wire mesh and disappears below. But remember that the waste doesn't vanish; it still goes somewhere, and that "somewhere" is usually just under the coop. So now *that* will need to be cleaned up from time to time. Some coops employ some sort of a removable tray under a wire floor, whereby coop cleanup involves pulling the tray out, cleaning it, and replacing it without ever interrupting the chickens.

- **Dirt:** Plenty of coops are built directly on the ground, using good old Mother Nature as the floor of the shelter. A dirt floor may sound like the ultimate in low-maintenance, but it has its downsides, too. Expect an increase in pests, and possibly even a burrowing predator or two. A dirt-floored coop can also be a nightmare to really clean out well (and there will be times you'll want to do just that).

REMEMBER

Whatever material the floor itself is made out of, practically all coop-owners choose to cover it with some type of loose bedding material. It's perhaps better thought of as *litter:* something that makes the floor of the shelter easier to clean and is topped off or replaced on a regular basis. The ideal bedding is absorbent and acts as an odor combatant (but only to a certain extent!). Most chicken-owners use wood shavings (pine being the most commonly available and the cheapest), but others have had success with sawdust, horse bedding, sand, and even finely-shredded landscape mulch.

Walls

The walls of your chicken coop offer perhaps the greatest amount of flexibility in terms of what material you elect to use. For many utilitarian coops, simple plywood (as discussed earlier in this chapter) will suffice. Other coop-builders may choose something else, either to make the coop look more attractive or in order to utilize a material they happen to already have on-hand. Check out this short list of some of the more widely-used wall materials:

- **Siding:** Most commonly made of wood, vinyl, or fiber cement (brands such as HardiePlank), siding is easy to install and quite versatile. You typically install horizontal planks over plywood sheathing and a weatherproofing layer of felt paper or housewrap. Using siding can allow you to match your own house or customize your coop with color.
- **Exterior paneling:** For a rustic look, consider a popular plywood product often referred to by contractors as T1-11 (pronounced "tee one-eleven"). With vertical grooves every 8 inches or so, this exterior-grade plywood is specifically designed for projects where the final look matters. It's sold in 4-x-8-foot sheets, just like regular plywood, with tongue-and-groove edges to allow sheets to fit together cleanly with no visible seam. It's usually unfinished, so whether you paint or stain it after the build is up to you and the chickens.

Roofing

Putting a roof over your flock's heads is practically the whole point of building a chicken coop. But there simply aren't that many materials you'd want to use to roof a coop. Here's the rundown.

Shingles

Most coops are roofed just like a home, using a multi-layered approach (see Figure 3-2) to make the structure weather-tight.

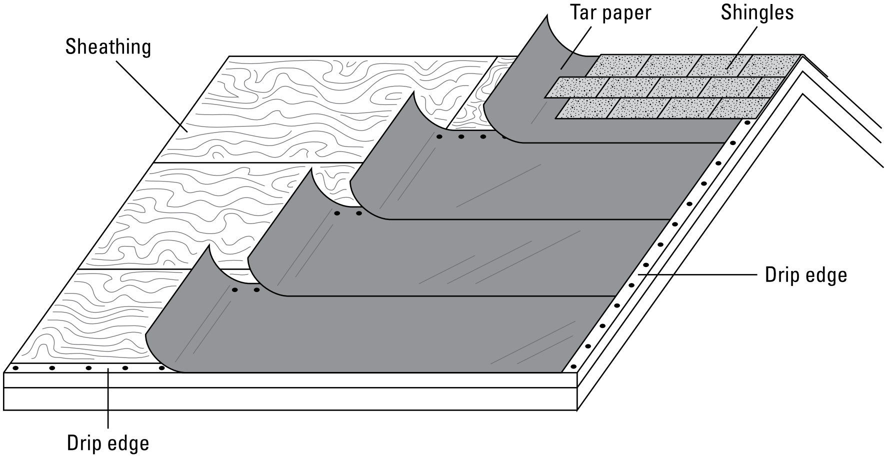


FIGURE 3-2: The anatomy of a typical shingled roof.

Here's what you should know about the layers that make up a shingled roof:

- The overlapping shingles, the outermost layer that's exposed to the elements, are most commonly made of asphalt, but can be found as cedar, metal, or even slate.
- Underneath the shingles is a layer of roofing paper, also called felt or tar paper. This underlayment serves the critical purpose of acting as a moisture barrier for the shingles. Shingles can become drenched during heavy rains; roofing paper keeps that water out of your chicken coop.
- The bottom layer of a typical roof is plywood sheathing, the solid surface that provides rigidity to the structure.

Shingles are fairly inexpensive and easy to install, requiring no special tools or hardware other than specialized roofing nails.

Corrugated panels

Corrugated panels, shown in Figure 3-3, are an inexpensive and lightweight alternative to shingles for many outdoor structures such as patios, carports, greenhouses, toolsheds, and — drum roll, please — chicken coops! These sheets, usually made of metal or translucent fiberglass, come in a variety of sizes and colors.

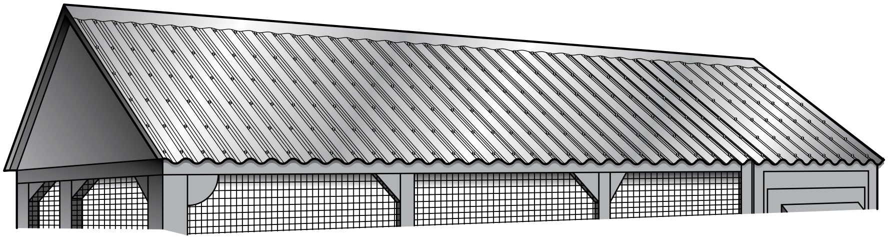


FIGURE 3-3: Corrugated roofing panels are lightweight and economical, but do require special hardware.

The translucent panels let in diffused light, which can aid in your chores and coop maintenance. But corrugated panels can be tough to work with. On a small-scale structure like a coop, you'll almost certainly have to cut the panels to size, which can be a tricky proposition for a DIYer because they're made of either metal or brittle fiberglass. Roof panels have a reputation for being easy to break, a real consideration if your coop will be located under tree limbs.

And finally, you'll have to buy installation accessories. To offer proper weatherproof protection, fiberglass panels must be used with special support pieces called *closure strips* and all panels require specialized fasteners that typically include some sort of rubber grommet to help create a watertight seal at each screw location.

Fencing in a chicken run

Proper living arrangements for your flock should include more than just a structure in which they can sleep protected at night, lay eggs undisturbed, or seek shelter from wind and rain. Most coop-builders also want to incorporate a *run* — an outdoor enclosure that's somewhat confined and protected, yet still exposed to fresh air and sunshine.

Without some kind of fencing material, those chickens are technically free-rangers. Making a smart selection about fencing material usually boils down to two factors: the material's strength and the size of the openings. When considering strength, remember that your fencing has to do more than just keep your flock contained. Even more important, it must keep predators from prying their way in, so stronger is better. Second, look at the openings in the fencing material you're considering. Just because a raccoon can't squeeze all the way through some types of fencing doesn't mean it offers adequate protection for your birds. A predator doesn't have to get all the way into a run to wreak bloody havoc. Nimble predators love to reach in with their arms and wave their razor-sharp claws around, trying to slash at chickens who wander too close.

Here are facts you should know about fencing as you design your run.

- **Chicken wire:** It seems like a no-brainer that a product actually called *chicken wire* should be the most obvious and best choice for fencing. Yes, it's easy to find, it's inexpensive, and it's quite malleable and therefore a cinch to work with. But most seasoned chicken-owners will tell you that true chicken wire, with its thin-gauge wire and wide hexagonal openings (see Figure 3-4), is far too lightweight to fend off any serious attack from a would-be chicken-snatcher.

- **Nylon/plastic:** Nylon and plastic are even more flexible than chicken wire, making them easier on your hands during building. Your options here may be spread all over your home center, from light garden netting all the way up to the heavy-duty orange snow fencing you often see on a highway construction project. Like chicken wire, though, plastic and nylon fencing tends to be great for keeping your chickens in — but not so great for keeping predators out.

  TIP

  If your neck of the woods is home to birds of prey, you may find garden netting or a similar lightweight material to be a low-cost and not-terribly-unattractive canopy for covering the top of the run, even if the walls of the run are made of something sturdier. Hawks and owls should be adequately deterred, but this type of flimsy material won't offer much defense against raccoons and other varmints that can climb the fence walls and go right through a nylon canopy.
- **Hardware cloth:** Often stocked right next to the chicken wire at your hardware store is something called *hardware cloth.* Wire stock — usually heavier than that of chicken wire — is woven and welded into a grid (with normally either ¼-inch- or ½-inch-square openings in the mesh), and it's often a sturdier choice for fencing a chicken run.
- **Welded wire:** Welded wire looks a lot like hardware cloth, but it's usually made with even heavier wire. Although it's stronger than hardware cloth, its openings are generally much larger as well, leaving your chickens more susceptible to the long and nimble arms of a raccoon.

TIP

Many coop-owners like to double up, layering a 1- or 2-foot-tall run of hardware cloth along the bottom of a full fence of welded wire. This two-ply approach takes advantage of the considerable strength of welded wire for the overall structure, but keeps precious chicks on the ground more safely contained behind the hardware cloth's tighter mesh.

Selecting the Right Coop for Your Flock

Based on zoning and neighborhood restrictions, location, utilities, drainage, and desired flock size, you may find that only one style of housing will work for your unique situation, or you may have your pick of the entire roster.

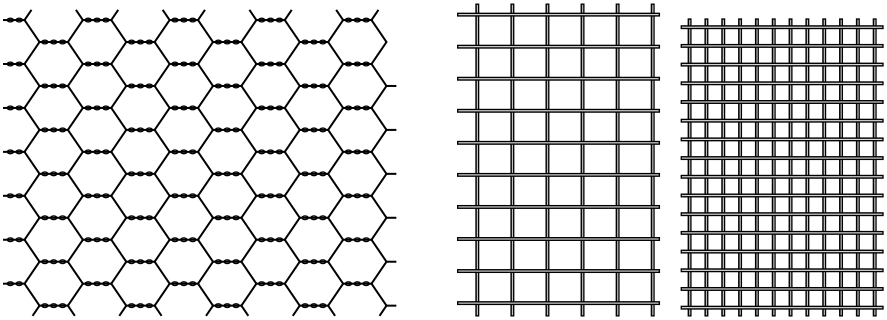


FIGURE 3-4: Chicken wire is a very lightweight run option. Hardware cloth is stronger.

Here's a quick thumbnail sketch of a few popular types. These aren't the only chicken coop styles out there, but they represent the most commonly seen coops and are all DIY-friendly.

A-frames and hoops

Taking the same concept in two geometrically-different directions, A-frame coops and hoop coops are among the simplest coops you'll typically find. They're great for small yards where space is at a premium and large flocks aren't practical. They're lightweight and easy to move from place to place in the yard.

Because of their small size and basic design, these coop styles require a minimum of materials and know-how to construct. They are, therefore, probably the least expensive coop types to build and great examples of what a low-cost hobby raising chickens can be. Here are a few details on both types:

- **A-frames:** An A-frame (see Figure 3-5) is long and triangular in shape. Two sides lean against one another and come to a point, serving as both the walls and the roof of the structure. Most often, a solid, covered shelter portion is connected to a fenced run portion in one long unit. Although the shelter generally has a floor, the run doesn't — it simply rests on the ground. Usually, both the shelter and the run have a door or hatch that's accessible from outside the coop.

  REMEMBER

  You can find full step-by-step plans for constructing an A-frame coop like this one later in this chapter.
- **Hoops:** A hoop coop (see Figure 3-6) is typically rounded and tunnel-shaped. Flexible piping (such as PVC) often makes up the frame, with some kind of bendable fencing material covering it. A simple tarp or solid fabric can be draped over a portion of the hoop to make a decent shelter. Many chicken owners with larger coops keep a hoop handy to use as temporary housing during the main coop's clean-out day. A small hoop coop can be very lightweight and may need to be anchored to the ground to keep it from tipping over in high winds.

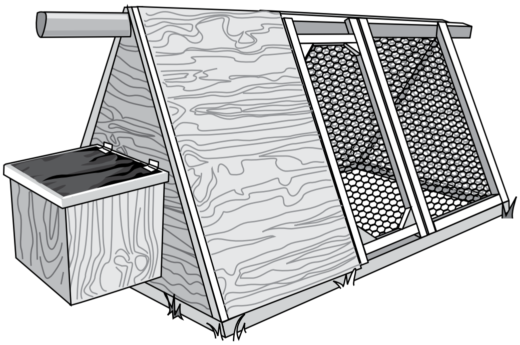


FIGURE 3-5: An A-frame coop gets an *A* for small-scale simplicity and efficient design.

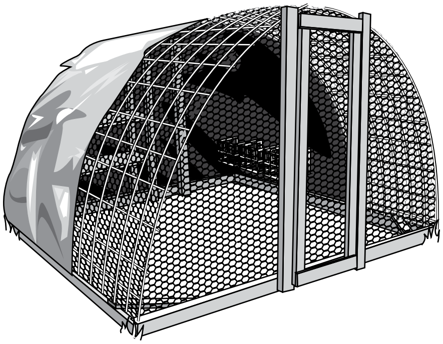


FIGURE 3-6: A hoop coop's well-rounded design is a cinch to assemble.

Chicken tractors

A chicken *tractor* (refer to Figure 3-7) is a type of housing that's meant to be moved from place to place. (A-frames and hoops, described in the preceding section, can be considered a subset of the tractor family.)

A tractor coop typically features a roof and four walls, but no bottom (except in the shelter). This allows the chickens to work the soil and fertilize different patches of ground, depending on where the chicken-keeper places the tractor.

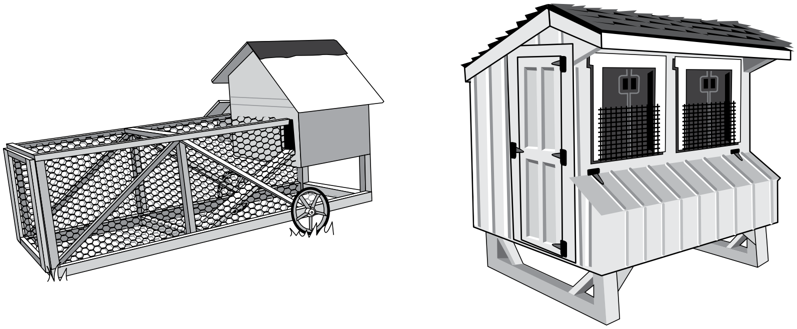


FIGURE 3-7: A chicken tractor is meant to be moved around on wheels or skids.

To facilitate moving the coop around the property frequently, most tractors are built either with wheels or on heavy lumber skids. Smaller tractors can be dragged by the chicken-owner (or the chicken-owner's oh-so-helpful-and-energetic kids), although larger, heavier tractors may require a real tractor to do the pulling.

All-in-one-coops

Many owners like how A-frames, hoops, and tractors incorporate the shelter and run into one unit, but don't need the coop to be portable and want it to be big enough for them to enter themselves. Welcome to the all-in-one coop.

As shown in Figure 3-8, an *all-in-one* coop usually features a shelter and a run under one tall roof that covers everything and provides human access to the run but not the shelter. This access — for egg-collecting, feeding, cleaning, and chicken-gathering — makes this an attractive coop style where carefree maintenance is a goal.

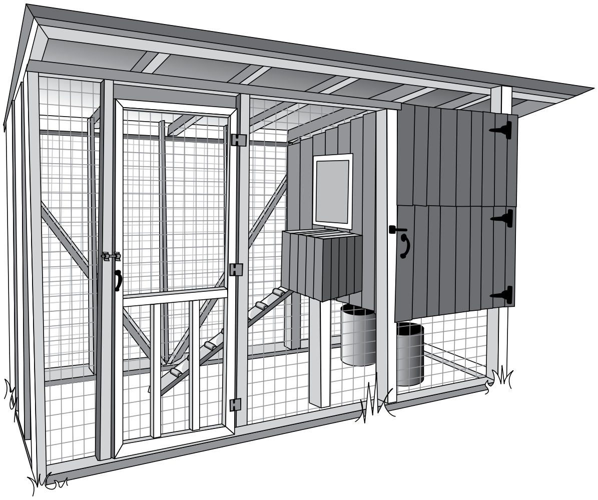


FIGURE 3-8: An all-in-one coop puts the shelter and run under one roof.

WARNING

All-in-one coops start to get larger than the styles previously outlined, with real stud walls, tall support posts, and an actual roof that includes rafters and such. The all-in-one coop is a big structure, tall enough for a human caretaker to enter, so the materials list can be lengthy. Building this coop style may require a good bit of skill and probably isn't a one-weekend kind of project.

Walk-in coops

If you have the property to pull it off and the skills to slap one together, a walk-in coop (as seen in Figure 3-9) is generally considered the primo option for backyard chicken-keepers. As the name says, a walk-in coop is large enough for you to stand upright in. (Think of it as a full-size toolshed with chickens living in it.) This obviously makes maintenance, cleaning, and all other chicken chores much easier on you, and it gives your flock a lot of room to move about inside their shelter.

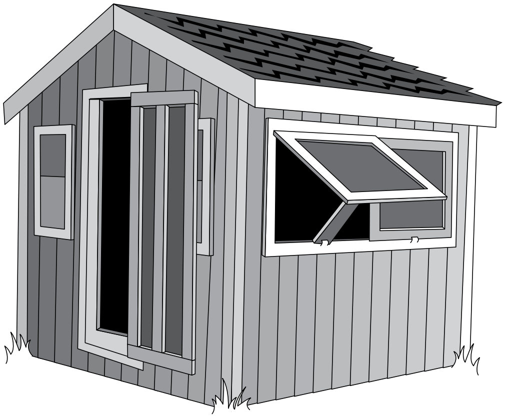


FIGURE 3-9: A walk-in coop is generally considered the "coop de ville" of chicken housing.

REMEMBER

The primary distinguishing feature of a walk-in coop is a heavy floor that allows you, the caretaker, to enter the shelter. The larger size also means you can increase the size of your flock more easily (or just start out with more chickens) than if you had a smaller coop.

But even the gold standard of chicken coops comes with a drawback or two. For starters, a walk-in is big. That means it takes up a lot of space, requires a lot of material, and demands a good deal of skill to build. This kind of coop will almost certainly take several weekends to construct, even for someone who knows what he's doing and invites friends over to help.

WARNING

Walk-in coops seldom factor in a run. The outdoor run is almost always a completely separate entity, to be designed, laid out, and incorporated however you see fit. That makes it like two fairly sizable projects, so keep that in mind as you decide.

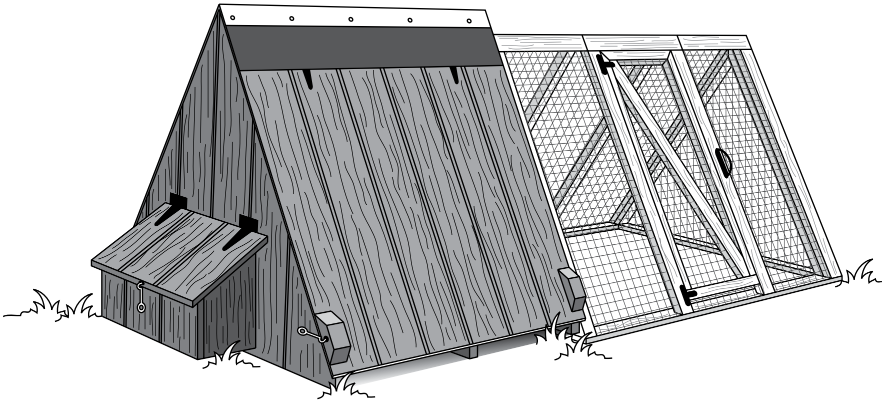
TIP

Most backyard chicken-keepers eventually end up with a walk-in coop, even if they start out with a smaller coop style. Don't be afraid to begin your hen hobby with a compact, low-cost A-frame, hoop, or tractor to test the waters. You can always graduate to a walk-in when your time and budget allow, and you'll have the smaller coop to use as a backup, for temporary housing during cleaning, or to quarantine sick birds from the others.

Constructing the Alpine A-Frame Coop

A simple A-frame coop takes up a minimum of yard space yet is ideally scaled for a small starter flock. A-frames often require just a modest list of basic building materials and can usually be built very quickly, even by a novice DIYer.

Because an A-frame is one of the most popular coop styles around, and often the perfect choice for the first-time chicken-keeper, coop-builder, or homesteader, it's the coop we teach you how to build in this chapter.



Vital stats

At a glance, here's how the Alpine A-frame stacks up in several key categories. Use these stats and selling points to determine whether the A-frame is the right coop for your flock as well as your building skills:

- **Size:** At roughly 4 feet wide and 10 feet long, it occupies just a small footprint in your yard and can easily be tucked into an out-of-the-way corner if needed. At its peak, it stands 46 inches high.

- **Capacity:** The shelter measures 16 square feet, and the run takes up 24 square feet, making this coop just right for two to four birds.
- **Access:** One entire side of the A-frame roof acts as a door that can be lifted open for easy cleaning and access, and then latched closed. Chickens have their own door to the run which can also be left open or latched shut.
- **Nest boxes:** Two nest boxes built into the exterior wall of the shelter share a top-opening (and latchable!) lid for hassle-free egg-gathering.
- **Run:** A large door positioned in the center of the run allows you to reach in to catch a chicken without having to crawl all the way inside.
- **Degree of difficulty:** The Alpine is one of the smallest coops featured, and is therefore one of the easiest to construct. Any homeowner with even a basic set of tools and rudimentary skills should be able to build this coop with relatively little trouble.
- **Cost:** Prices will vary considerably, of course, but assuming that you have all the tools you need, you could easily purchase all of the materials to build this coop from scratch for well under $300.

Materials list

The following is a list of the materials that we used to construct the Alpine. In most cases, substitutions may be made as needed or desired.

Lumber		Hardware		Fasteners	
3	4′ x 8′ sheets of T1-11	1	4′ x 16′ panel of 1″ x 2″ wire mesh	70	2½″ wood screws or 12 nails
1	4′ x 4′ sheet of 7⁄16″ OSB	1	piece of metal 6″ x 49″ (bent lengthwise in the middle)	140	1¼″ screws or 7d nails
3	4′ lengths of 2x4 pressure-treated lumber	1	piece of rubber 8″ x 48½″	120	1¼″ fencing staples
3	6′ lengths of 2x3 pressure-treated lumber	8	5″ T-style hinges		
18	6′ lengths of 2x3 lumber	3	hook-and-eye latches		
1	4′ length of 2x2 lumber	1	gate latch		
2	6′ lengths of 1x3 pressure-treated lumber				
2	6′ lengths of 1x3 lumber				
1	8′ length of 1x2 lumber				

Cut list

This section breaks down how the materials should be cut to create the appropriate-sized pieces you need to assemble the Alpine as shown.

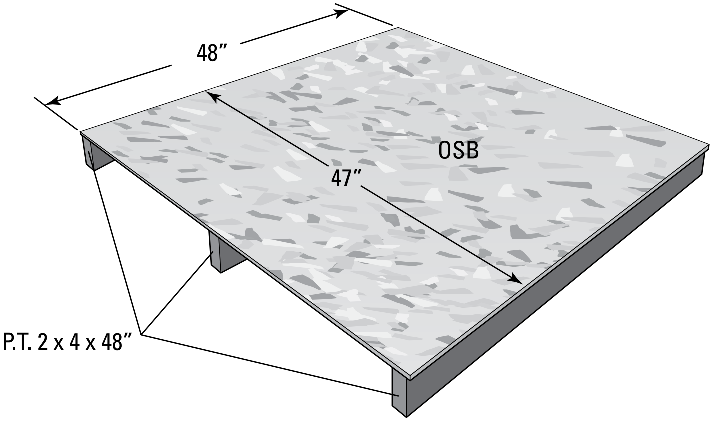
REMEMBER

This coop features several pieces that are cut on an angle. You'll see boards throughout the cut list that specify L.P. or S.P. Here are the details:

- *L.P.* stands for *long point,* where the board's listed length refers to the tip-to-tip measurement at the board's longest point, with the angle making one side shorter.
- *S.P.* is an abbreviation for *short point.* When you see it, know that the board's listed length measures just to the end's shortest point, meaning that the long end of the board will be greater than the cut list's specified length. For example, a 2x4 listed as 36 inches S.P. with a 45-degree angle will actually be almost 39½ inches long at its longest point.

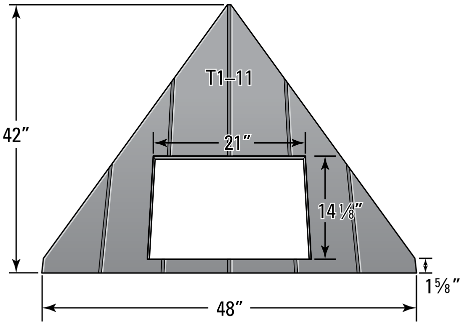
Shelter floor

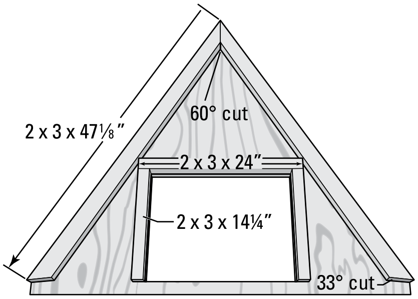
Quantity	Material	Dimensions
1	OSB	48" x 47"
3	Pressure-treated 2x4s	48" long



Gable 1 (nest box side)

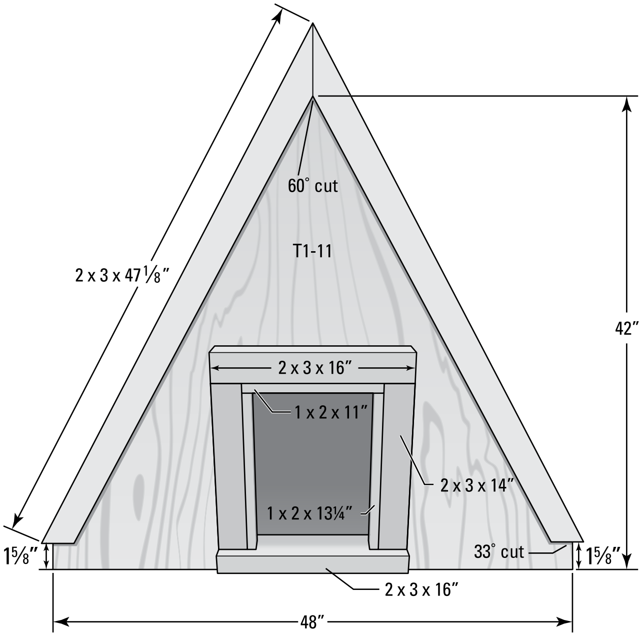
Quantity	Material	Dimensions	Notes
1	Sheet of T1-11	48″ wide x 42″ high	From top center point, cut both sides at a 30-degree angle to leave vertical edge 1⅝″ high at each bottom corner
2	2x3s	47⅛″ long L.P. to L.P.	One end trimmed at a 60-degree angle and the other end trimmed at a 33-degree angle
1	2x3	24″ long	
2	2x3s	14¼″ long	


T1–11
42″
21″
14⅛″
1⅝″
48″


2 x 3 x 47⅛″
60° cut
2 x 3 x 24″
2 x 3 x 14¼″
33° cut

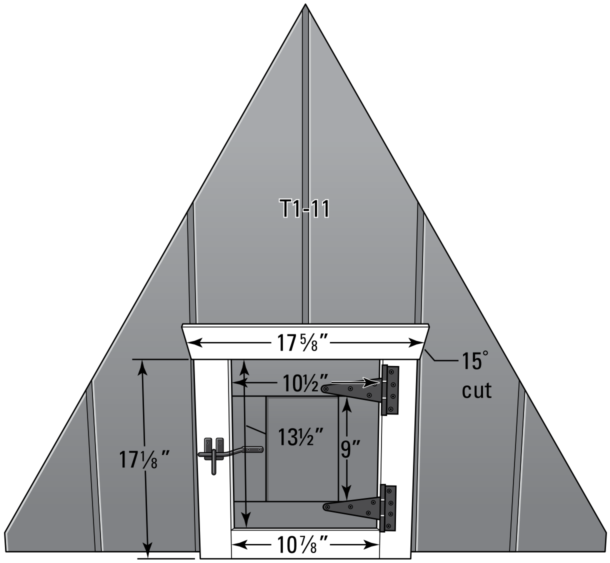
Gable 2 (run side, interior)

Quantity	Material	Dimensions	Notes
1	Sheet of T1-11	48″ wide x 42″ high	From the top center point, cut both sides at a 30-degree angle to leave a vertical edge 1⅝″ high at each bottom corner
2	2x3s	47⅛″ long L.P. to L.P.	One end trimmed at a 60-degree angle and the other end trimmed at a 33-degree angle
2	2x3s	16″ long	
2	2x3s	14″ long	
2	1x2s	13¼″ long	
1	1x2	11″ long	


60° cut
T1-11
2 x 3 x 47⅛″
42″
2 x 3 x 16″
1 x 2 x 11″
2 x 3 x 14″
1 x 2 x 13¼″
1⅝″
33° cut
1⅝″
2 x 3 x 16″
48″

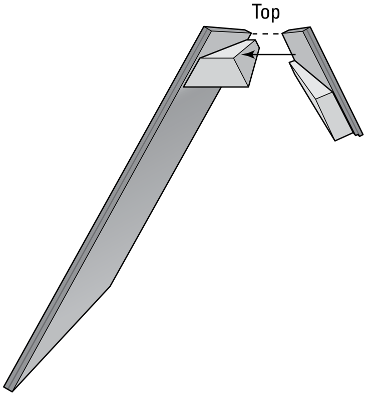
Gable 2 (run side, exterior) with run door

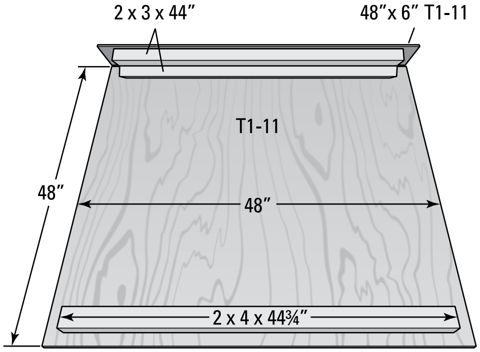
Quantity	Material	Dimensions	Notes
1	Sheet of T1-11	10½″ wide x 13½″ high	
1	Pressure-treated 1x3	17⅝″ long L.P. to L.P.	Ends trimmed at a 15-degree angle
2	Pressure-treated 1x3s	17⅛″ long	
1	Pressure-treated 1x3	10⅞″ long	
2	Pressure-treated 1x3s	10½″ long	
2	Pressure-treated 1x3s	9″ long	



Roof panel 1 (fixed side)

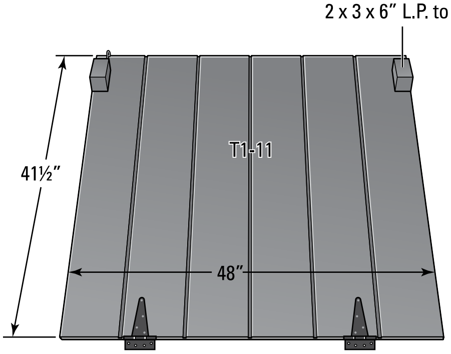
Quantity	Material	Dimensions	Notes
1	Sheet of T1-11	48″ wide x 48″ high	
1	Sheet of T1-11	48″ wide x 6¼″ high	
1	2x4	44¾″ long	Cut down both long sides at a 30-degree angle. (This creates a 44″-long board that's 3½″ on the bottom and 1⅞″ on the top.)
2	2x3s	44¾″ long	

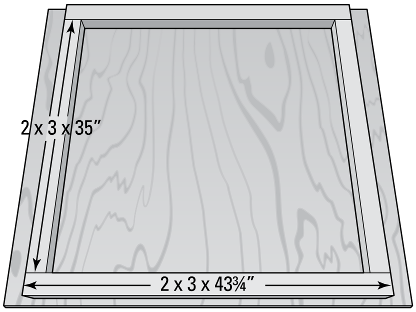



2 x 3 x 44″
48″x 6″ T1-11
T1-11
48″
48″
2 x 4 x 44¾″

Roof panel 2 (hinged door)

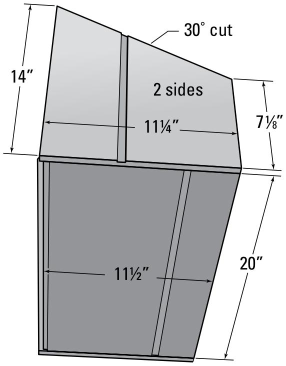
Quantity	Material	Dimensions	Notes
1	Sheet of T1-11	48″ wide x 41½″ high	
2	2x3s	43¾″ long	
2	2x3s	35″ long	
2	2x3s	6″ long L.P. to L.P.	Both ends trimmed at a 45-degree angle

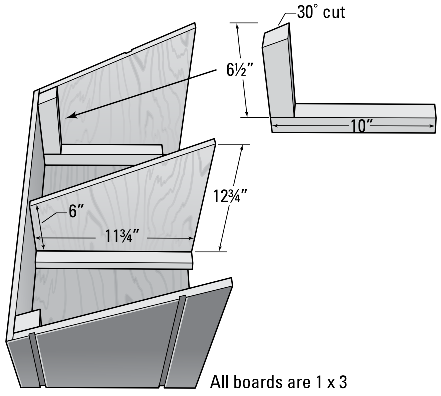

2 x 3 x 6″ L.P. to L.P.
T1-11
41½″
48″

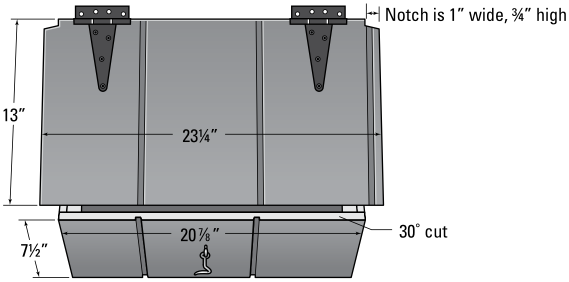

2 x 3 x 35″
2 x 3 x 43¾″

Nest boxes

Quantity	Material	Dimensions	Notes
1	Sheet of T1-11	23¼″ wide x 13″ high	Cut notches into back corners that measure 1″ wide x ¾″ high (nest boxes' lid)
1	Sheet of T1-11	20⅞″ wide by 7½″ high	Top edge trimmed at a 30-degree angle (nest boxes' front)
1	Sheet of T1-11	20″ wide x 11½″ high	(Nest boxes' bottom)
1	Sheet of T1-11	11¾″ wide x 12¾″ high (back) and 6″ high (front)	(Nest boxes' divider)
2	Sheets of T1-11	11¼″ wide x 14″ high (back) and 71⁄8″ high (front)	(Nest boxes' sides)
1	1x3	11¾″ long	(Inner blocking)
2	1x3s	10″ long	(Inner blocking)
2	1x3s	6½″ long	One end trimmed at a 30-degree angle (inner blocking)


30° cut
14″
2 sides
11¼″
7⅛″
11½″
20″


30° cut
6½″
10″
12¾″
6″
11¾″
All boards are 1 x 3

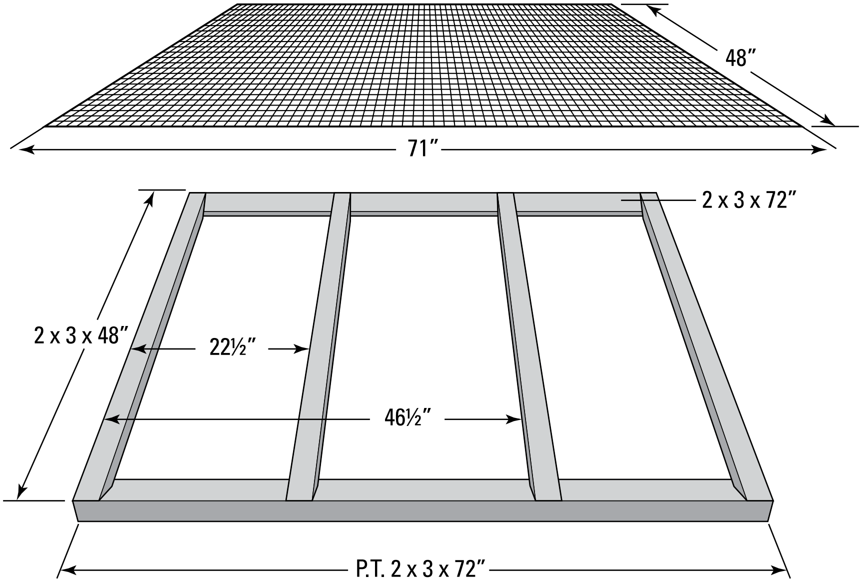

Notch is 1″ wide, ¾″ high
13″
23¼″
20⅞″
7½″
30° cut

Roost

Quantity	Material	Dimensions	Notes
1	2x2	47″ long	Not shown

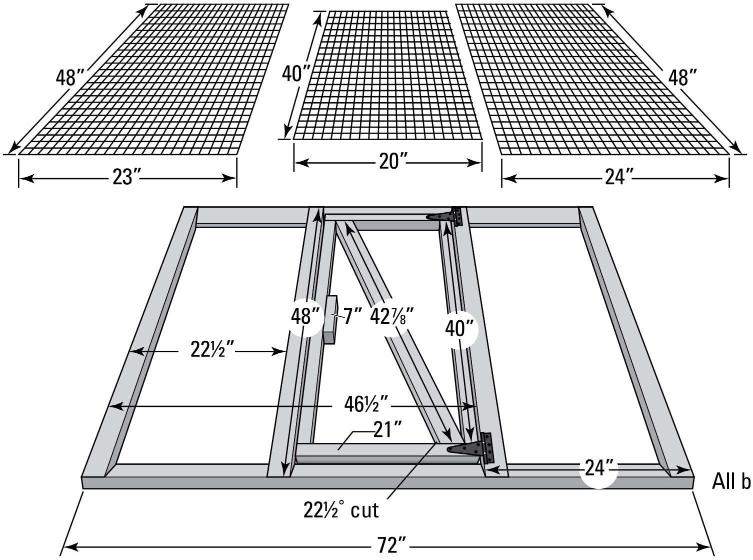
Run panel 1

Quantity	Material	Dimensions	Notes
1	Pressure-treated 2x3	72″ long	(Bottom)
1	2x3	72″ long	(Top)
4	2x3s	48″ long L.P. to L.P.	One end trimmed at a 60-degree angle and the other end trimmed at a 30-degree angle
1	Wire panel	48″ x 71″	



Run panel 2 with door

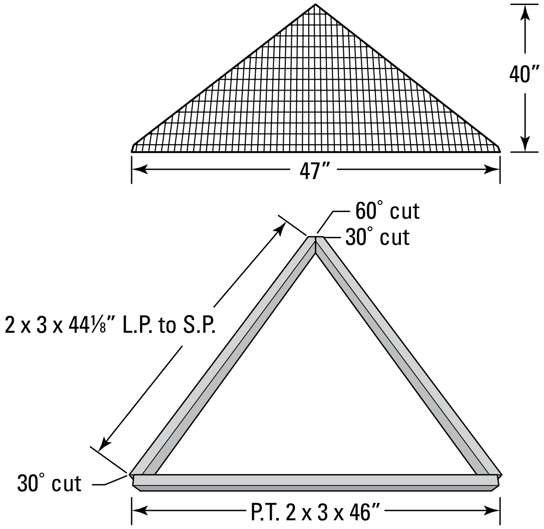
Quantity	Material	Dimensions	Notes
1	Pressure-treated 2x3	72″ long	(Bottom)
1	2x3	72″ long	(Top)
4	2x3s	48″ long L.P. to L.P.	One end trimmed at a 60-degree angle, and the other end trimmed at a 30-degree angle
1	2x3	42⅞″ long L.P. to S.P.	Both ends trimmed at a 22½-degree angle
2	2x3s	40″ long	
2	2x3s	21″ long	
1	2x3	7″ long	(Blocking for latch)
1	Wire panel	24″ x 48″	(Shelter-end panel)
1	Wire panel	23″ x 48″	(Far-end panel)
1	Wire panel	20″ x 40″	(Door panel)



All boards are 2 x 3

Run gable

Quantity	Material	Dimensions	Notes
1	Pressure-treated 2x3	46″ long	(Bottom)
2	2x3s	44⅛″ long L.P. to S.P.	Start with a 2x3 that's 46½″ long. Trim the bottom end to a 30-degree angle. Trim the top end to a 60-degree angle, so that if you rest the 30-degree end flat on the ground, the 60-degree cut is plumb. Now measure up from the bottom of the 2x3 and mark the 44⅛″ spot. Make a 30-degree cut at this mark (the cut should run horizontally, or parallel with the bottom cut).
1	Wire panel	47″ by 40″	Cut to 40″ high triangle



Assembling the coop

Rookie DIYers will appreciate the fact that each piece of the Alpine can be assembled as an individual unit. After all the pieces are created, it's simply a matter of putting them together.

1. **Begin with the shelter.**

   a. Secure the shelter floor to its 2x4 runners.

   b. Assemble the triangular gables. On the nest box side, cut an opening that is 21 inches wide and 14⅛ inches tall. The opening should be located 1⅝ inches up from the bottom edge of the T1-11 and centered. Attach the gables in place at the floor.

   c. Follow by building roof panel 1 (the fixed side). Then fasten the base to the shelter floor. The 2x3 bracing inside the roof panel and gables should help "lock" the pieces together while you screw everything in place.

   d. Assemble roof panel 2 and fasten to roof panel 1 with two T-style hinges; place the hinges about 10 inches from the door's edges, and use the screws provided. The base of the roof door shouldn't be attached to anything, so that the door may open freely. Two hook-and-eye latches screwed into small wooden cleats and the shelter floor can lock the door in the closed position.

   TIP

   e. Our design features a piece of metal at the shelter peak to keep rainwater from running down into the coop. Use heavy-duty construction adhesive to glue the flashing to the coop. If the flashing is heavy enough to stay put on its own, you can simply allow it to rest in place — no permanent attachment is necessary.

   TIP

   f. A short length of rubber is draped over the hinged door's seam in our design. This serves as a flexible strip of flashing that lets rainwater from the metal peak bypass the door's seam and shed right off onto the roof panel itself while still allowing the door to be opened. A scrap piece of rubber pond liner or a swatch of heavy-duty plastic sheeting should do the trick on your coop.

2. **Add the nest boxes and roost.**

   a. Use the diagrams that appear in the earlier section to cut and assemble the pieces for the nest boxes.

   b. Insert the box into the appropriate gable hole and fasten it in place.

c. Secure the nest box lid in place to the coop's exterior wall with two T-style hinges, fastened with the screws provided. A hook-and-eye latch, with one end threaded into the lid and the other end threaded into the front of the box, locks it shut.

d. Add the roost bar.

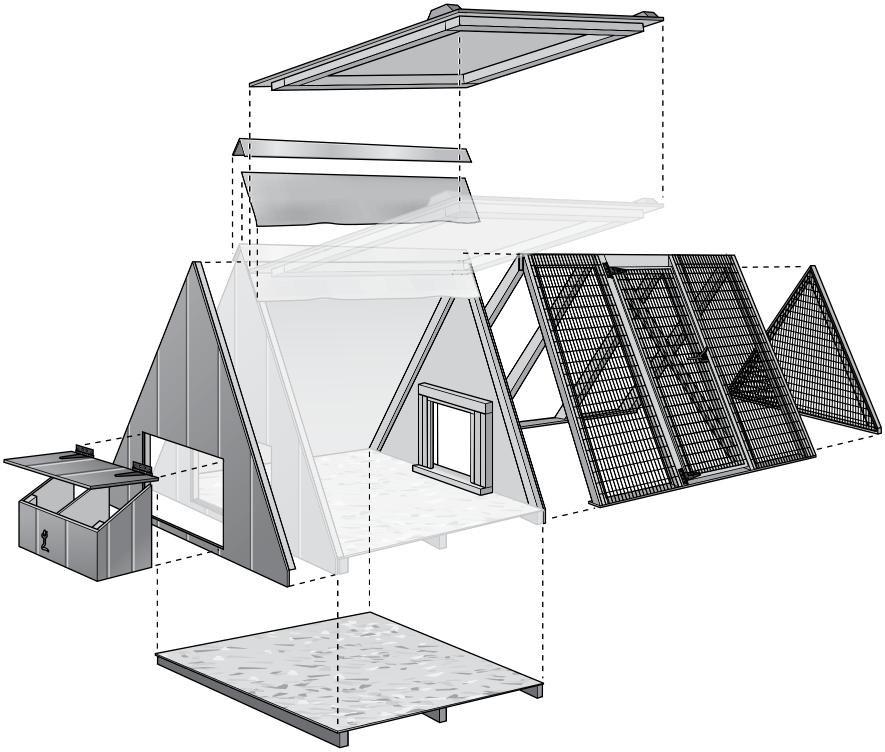
3. **Assemble the run.**

a. Build the run panels and door, along with the run gable, according to the diagrams that appear earlier. Then staple wire mesh in place at each section.

REMEMBER

b. The panel without the door can be covered by one large piece of fencing, but treat run panel 2 (with the door) as three distinct panels, each needing its own section of fencing.

c. Add a latch to the run's door panel. We used a self-locking model (which you would typically see on a fence gate, but almost any style you prefer (barrel bolt, hook-and-eye, hasp) can be made to work. Use the hardware provided to fasten it to the run's door panel.



Index

A

absconding, 498
acclimating, to gardening conditions, 9–11
accompaniments, canning, 224, 226–229
acidic soil, for blueberries, 60
acidity, of food, 193–194
active dry yeast, 426
adaptation, of vegetables, 42
adding
  nutrients with cover crops and green manures, 145–148
  organic matter, 75–76
additives, for soap, 452–454
adjuncts, for homebrewing, 377
adult layer ration, 532
aeroponics, 179–180
AFB (American foulbrood), 501
A-frame chicken coops, 612, 613, 616–629
A-frame trellis, 562–563
aggressive grasses, killing, 67–68
AHS Heat Zone Map, 10–11
air bubbles, releasing during canning, 192–193
air-drying herbs, 351
alcohol content, 375, 383
ale yeast, 376
allergies, from bee stings, 460–461
all-in-one coops, 614
all-purpose enriched flour, 427
almond oil, as soap additive, 454
aloe vera, as soap additive, 454
altitude
  adjusting for, 194, 206–207
  pressure canning at higher, 242–243
aluminum flashing, for building beehives, 585
amaranthacaea, 170
Amber Link chickens, 521
amendments, 72
Ameraucana chickens, 522–523
American foulbrood (AFB), 501
American Horticulture Society (website), 11
Amish Applesauce Bread recipe, 437
Ancona chickens, 519
Andalusian chickens, 519
Angora rabbit, 554
animals. *See also* beekeeping; chickens
  about, 553
  ducks, 556–558
  fish, 558
  geese, 556–558
  goats, 555–556
  keeping out of garden, 26–33
  rabbits, 554–555
  turkeys, 558
anise
  for companion planting, 168
  uses for, 62
annual, 146
annual ryegrass, 146
antioxidant solutions, 208
antioxidants
  dipping fruit in before drying, 327
  in nuts, 59–60
  preventing fruit discoloration with, 296
aphids, 159–160
apiaceae, 170
Apiguard, 506
Apivar, 506
appearance, of vegetables, 42
Apple Pie Filling recipe, 215
apples
  canning, 211, 214, 215, 216
  drying, 328, 330
  freezing, 298, 299
  preparing for cold storage, 364

Applesauce recipe, 216
applying
  fence finish, 94
  lime, 74–75
  sulfur, 74–75
apricot kernel oil, as soap additive, 454
apricots
  canning, 212, 217–218
  drying, 328, 330
  freezing, 298
  as soap additive, 454
aquaponics, 179
Araucana chickens, 523
ascorbic acid
  dipping fruit in before drying, 327
  for preventing discoloration in fruit, 208
asparagus
  growing, 52, 58
  harvesting, 152
  pickling, 276, 284
  planting guidelines for, 121
  pressure canning, 247, 251
asphalt roofing shingles, for building beehives, 585
asteraceae, 170
Australorp chickens, 521
automatic vent opener, 177
autumn, beekeeping during, 475–476
autumn syrup recipe, 477

B

Bantam breeds, 517
bark mulches, 141
barley malt, 374
Barnevelder chickens, 517
barrels, harvesting rainwater in, 84–85
barriers, for controlling pests, 165
Basic White Buttermilk Bread recipe, 433
basil
  for companion planting, 168
  freezing, 316
  uses for, 62
basins, 80
baskets, 38
bays, 87
beans
  for container planting, 22
  drying, 340, 342
  freezing, 304, 306
  harvesting, 152
  pickling, 276, 285–286
  planting guidelines for, 121
  pressure canning, 247, 252
  side-dressing, 139
  watering guidelines for, 127
bee brush, for beekeeping, 472
bee repellent, 489
beekeeping
  about, 457, 473
  absconding, 498
  building a beehive, 581–601
  choosing hives, 461–467
  colony collapse disorder (CCD), 506–508
  costs and equipment, 459
  environmental considerations, 458–459
  equipment for, 467–472
  fighting disease, 498–502
  fighting varroa mites, 502–506
  five-frame nuc (nucleus) hive, 466–467
  harvesting honey, 485–495
  honey, 481–495
  Kenyan top bar hive, 463–464
  Langstroth hive, 462
  legal restrictions, 459
  nervous neighbors, 461
  quantity of hives needed, 460
  schedule of seasonal activities, 474–481
  stings and allergies, 460–461
  swarming, 496–498
  time and commitment, 460
  types of honey bees, 460
  Warré (people's) hive, 464–466
  zoning restrictions, 459
bee-proof clothing, 467–469

beer. *See* homebrewing
beeswax
  about, 442
  as soap additive, 454
beeswax candles, rolling, 444–445
beets
  for container planting, 22
  drying, 340, 343
  growing tips for, 54–55
  harvesting, 152
  pickling, 277, 287–288
  planting guidelines for, 121
  preparing for cold storage, 365
  pressure canning, 247–248, 253–254
  side-dressing, 139
bell peppers
  freezing, 304, 307
  pressure canning, 248, 255
bench capper, 387
berries
  canning, 212–213, 219, 220
  freezing, 298, 300
  growing, 60–62
Berseem clover, 147
bevel, 91
beverages, fermenting, 416–424
biological controls, for controlling pests, 165
bird tunnel, 33
birds, keeping out of garden, 32–33
Black Star chickens, 521
black walnut, 60
blanching vegetables, 303–304
blueberries
  canning, 220
  drying, 329, 331
  freezing, 300
  tips for growing, 60–61
Blueberry Muffins recipe, 439
boiling water, for rehydrating, 328
boiling-water canner, 185
boiling-water canning. *See* water-bath canning
bolt, 96, 113
border fork, 36–37
botanical insecticide, for controlling pests, 165–166
bottling homebrew, 383–388
bottom-fermenting strain, 376
Brahma chickens, 517–518
brassicaceae, 170
bread, baking
  about, 425
  increasing rising, 430–431
  mixing and kneading, 428–430
  recipes for, 432–440
  shaping and baking loaves, 431–432
  yeast breads, 425–428
bread flour, 427
breaker attachment, 117
brining
  about, 272–274
  for fermenting, 394
broadcast, 107
broadfork, 37
broccoli
  for container planting, 22
  freezing, 304, 308
  growing tips for, 53–54
  harvesting, 152
  overhardening, 113
  planting guidelines for, 121
  pressure canning, 244
  side-dressing, 139
  watering guidelines for, 127
broiler rations, for chickens, 532–533
brood nest, 481
brooders, for chickens, 537–540
brown-egg layers, 520–522
Brussels sprouts
  freezing, 304, 309
  growing tips for, 54
  harvesting, 152
  pickling, 277, 289
  planting guidelines for, 121
  pressure canning, 244
  side-dressing, 139
  watering guidelines for, 127

buckets, 38
buckwheat, 147
building
  beehives, 581–601
  chicken coops, 603–629
  cold frames, 567–568
  compost bins, 573–578
  fencing, 87–94
  Kenyan top bar hives, 587–601
  raised garden beds, 565–567
bush beans, for succession planting, 150
bush tomatoes, 50
bush zucchini, 48
butter, 405
buttermilk, 405
Buttermilk Biscuits recipe, 440
buying starter plants, 112–113

C

cabbage
  for container planting, 22
  growing tips for, 53
  harvesting, 152
  overhardening, 113
  planting guidelines for, 121
  preparing for cold storage, 365
  pressure canning, 244
  for rotating crops, 169
  side-dressing, 139
  watering guidelines for, 127
cadmium, 190
call811 (website), 15
candlemaking
  about, 441–442
  molded candles, 445–447
  rolling beeswax candles, 444–445
  tapers, 447–449
  wax types, 442–443
  wicks, 443–444
Canned Apples recipe, 214
Canned Apricots, Nectarines, and Peaches recipe, 217–218
Canned Asparagus recipe, 251
Canned Beets recipe, 253–254
Canned Bell Peppers recipe, 255
Canned Blueberries recipe, 220
Canned Carrots recipe, 256–257
Canned Corn recipe, 258–259
Canned Creamed Corn recipe, 260–261
Canned Fresh Green Beans recipe, 252
Canned Onions recipe, 262–263
Canned Peas recipe, 264
Canned Raspberries recipe, 219
Canned Summer Squash recipe, 267
Canned Sweet Potatoes recipe, 266
Canned Tomatoes recipe, 221
Canned White Potatoes recipe, 265
canning
  about, 183
  accompaniments, 224, 226–229
  apples, 211, 214, 215, 216
  apricots, 212, 217–218
  berries, 212–213, 219, 220
  blueberries, 220
  citric acid for, 202, 208
  equipment for, 185–191
  fresh fruit, 207–222
  green tomatoes, 224
  headspace for, 191–192
  lining jars with liquid when, 209–211
  nectarines, 212, 217–218
  peaches, 212, 217–218
  pressure
    asparagus, 247, 251
    beans, 247, 252
    beets, 247–248, 253–254
    bell peppers, 248, 255
    broccoli, 244
    Brussels sprouts, 244
    cabbage, 244
    carrots, 248, 256–257
    cauliflower, 244
    corn, 249, 258–259, 260–261
    cucumbers, 244

    - eggplant, 244
    - at higher altitude, 242–243
    - Instant Pot for, 233
    - mushrooms, 244
    - onions, 249, 262–263
    - parsnips, 244
    - peas, 249, 264
    - potatoes, 249–250, 265
    - recipes for, 250–267
    - rutabagas, 244
    - summer squash, 249–250, 267
    - sweet potatoes, 249–250, 266
    - turnips, 244
    - yams, 249–250
  - raspberries, 219
  - releasing air bubbles during, 192–193
  - safety, 191–195
  - safety and, 191–195
  - starting, 183–184
  - steam, 199
  - strawberries, 212
  - summer squash, 227–228
  - tomatoes, 213, 221, 222, 226
  - water-bath
    - about, 197–198
    - accompaniments, 224, 226–229
    - adjusting for altitude, 206–207
    - for fresh fruit, 207–222
    - in Instant Pot, 200
    - Instant Pot for, 200, 233
    - jams, 223–224, 225
    - low-acid foods, 232
    - preparing for, 198–199
    - recipes for fresh fruit, 211–222
    - reprocessing unsealed jars, 205
    - steam canning, 199
    - step-by-step process of, 200–206
- canning jars, 199
- cans, watering, 34
- caraway, 62
- carbonated drinks, 417–418
- cardboard mulch, 144
- carrots
  - for container planting, 22
  - drying, 340, 344
  - growing tips for, 55
  - harvesting, 152
  - planting guidelines for, 121
  - preparing for cold storage, 366
  - pressure canning, 248, 256–257
  - side-dressing, 139
  - watering guidelines for, 127
- carts, 39
- castings, 134
- caterpillars, 160–161
- catnip
  - for companion planting, 168
  - uses for, 62
- cattle panels, 564
- cauliflower
  - for container planting, 22
  - freezing, 305, 310
  - harvesting, 152
  - planting guidelines for, 121
  - pressure canning, 244
  - side-dressing, 139
  - watering guidelines for, 127
- CCD (colony collapse disorder), 506–508
- cedar, for chicken coops, 605
- cedar shake shingles, for building beehives, 585
- cedar wood, for building beehives, 583
- celery
  - harvesting, 152
  - planting guidelines for, 121
  - side-dressing, 139
- Chalkbrood, 500
- chalkline, 90
- chamomile, drying, 350–352
- charentais melons, 47
- Cheat Sheet (website), 3
- CheckMite+, 506
- cheese, 405, 408–409
- chemical fertilizers, 137
- cherries, drying, 329, 332

Cherry Egger chickens, 521
Chevre (goat cheese) recipe, 414
chicken coops, building, 603–629
chicken tractors, 613–614
chicken wire, for chicken coops, 610–611
chickens
  about, 509, 529
  Bantam breeds, 517
  breeds, 516–525
  care and requirements for, 510–512
  coops, 525–528
  dual-purpose breeds, 516, 517–518
  egg layers, 513, 515, 516, 518–523
  eggs for eating, 549–552
  feeding, 529–536, 541–543
  legal issues, 510
  meat breeds, 513, 516, 517, 523–525
  pests and predators, 544–548
  raising baby chickens, 536–544
  show breeds, 517
  specific considerations for, 512–516
children, chickens and, 543–544
Chinese cabbage
  planting guidelines for, 121
  succession planting, 150
chives, 62
choosing
  cover crops, 146–147
  fertilizers, 136
  hives, 461–467
  mulch, 144–145
  pots, 105–106
  seeds, 102–103
  transplants, 102–103
cilantro
  freezing, 316
  uses for, 62
cisterns, 85
citric acid, for canning, 202, 208
citrus fruit
  drying, 329, 333
  freezing, 294
clamshell digger, 88
clay, as soap additive, 454
clay soil, 14, 70, 81
cleaning
  eggs, 550
  for fermenting, 392
clear pine, for building beehives, 582
cleats, 89
clover, 147
cocoa butter, as soap additive, 454
cold frames
  building, 567–568
  for extending growing season, 173–175
cold (raw) packing, 245–246
cold storage
  about, 357
  finding, 357–362
  preparing foods for, 364–368
  root cellar, 359
  rubber trash cans, 362
  rules for, 362–364
  stairwells, 359–360
  storm shelters, 360
  straw-bale storage, 361–362
cole crops, for container planting, 22
collards, succession planting, 150
colony collapse disorder (CCD), 506–508
color, of plastic mulch, 143
colored-egg layers, 522–523
commercial feeds, for chickens, 531–533
common garden hoe, 35
companion planting, 167–169
complete fertilizer, 136
Complete Guide to Home Canning and Preserving, 211
compost, 76
compost bins, building, 573–578
composting
  about, 128–129
  bagged compost, 129
  in bulk, 129–130
  making your own, 130–133

  - recipes for, 132
  - wood and wire thee-bin composter, 574–578
  - worms and, 134
- concrete, for chicken coops, 607
- construction lumber, for chicken coops, 604–605
- container vegetables, 21–23
- containers
  - for cold storage, 363–364
  - for dried food, 325
  - for fermenting, 390–391
  - for freezing, 292
- conventional oven, for drying, 322–323
- cooking characteristics, of vegetables, 42
- cool-season vegetables
  - frost dates for, 97
  - mulch for, 144–145
  - planting, 96
- Cooperative Extension Service, 72
- coops, chickens, 525–528
- copper flashing, for building beehives, 585
- corn
  - freezing, 305, 311
  - growing tips for, 51–52
  - harvesting, 152
  - planting guidelines for, 122
  - pressure canning, 249, 258–259, 260–261
  - for rotating crops, 169
  - side-dressing, 139
  - watering guidelines for, 128
- corn earworms, 161
- corn gluten meal, 158
- Cornish chickens, 524
- Cornish X Rock broiler hybrids, 532
- Cornish X Rock hybrid chickens, 524
- corrugated panels, for chicken coops, 609–610
- cos lettuce, 52
- costs
  - for beekeeping, 459
  - for chickens, 512
- Cottage Cheese recipe, 413
- cover crops
  - about, 145–146
  - advantages of using, 146
  - choosing, 146–147
  - planting, 147–148
- coverings, applying, 67–68
- covers, for pressure canners, 234–235
- coyotes, as predators to chickens, 548
- crenshaw melons, 47
- crisphead lettuce, 52
- crocks, 190–191
- crops
  - cover, 145–148
  - rotating, 169–170
- crown, 61
- cruciferous vegetables, growing tips for, 52–54
- crumbles, for chickens, 533
- crush-and-strain method, of beekeeping, 493
- cucumbers
  - for container planting, 22
  - freezing, 294
  - growing tips for, 46–47
  - harvesting, 152
  - pickling, 275–276
  - planting guidelines for, 122
  - pressure canning, 244
  - side-dressing, 139
  - as soap additive, 454
  - succession planting, 150
  - watering guidelines for, 128
- cultivating soil, 157
- cultivators, 35
- cultured butter, 405
- culture, for fermenting, 391
- curcurbitaceae, 170
- cure, 56
- cutworms, 161–162
- cypress wood, for building beehives, 582–583

D

- dairy, fermenting, 405–415
- damping off, 106, 110
- daughtering, 61
- day-neutral onions, 57
- days to maturity, of vegetables, 42

deer, keeping out of garden, 27–29
dehydrating. *See* drying
developer or finishing pullet ration, 532
dial gauge, for pressure canners, 236
Diamond brand, 270
digging fork, 36–37
dill
  drying, 352–353
  uses for, 62
Dilly Beans recipe, 285–286
dimensional lumber, 583–584
dipping fruit, before drying, 327
direct seeding, 103
dirt floors, for chicken coops, 608
discoloration, preventing for fruit, 208–209
disease, beekeeping and, 498–502
distilled water
  for homebrewing, 377
  as a pickling ingredient, 271
dogs, as predators to chickens, 548
dolomitic limestone, 74
double dig, 78
drainage, of soil, 14–15
Dried Apples recipe, 330
Dried Apricots recipe, 330
dried beans. *See* beans
Dried Beets recipe, 343
Dried Blueberries recipe, 331
Dried Carrots recipe, 344
Dried Cherries recipe, 332
Dried Citrus Peel recipe, 333
Dried Greens recipe, 345
Dried Peas recipe, 346
Dried Pineapple recipe, 334
Dried Potatoes recipe, 347
Dried Shell Beans recipe, 342
drip irrigation, 82–84
drip line, 14
drone comb, 505
drop spreader, 74
dropped fruit, 208
dry or unsweetened pack, 296
dry salt, for fermenting, 394
dry sugar pack, 296
drying
  about, 319
  conventional oven, 322–323
  electric dehydrator, 320–322
  fruit, 325–337
  herbs, 350–355
  methods for, 320–324
  protecting dried food, 324–325
  sun, 323–324
  tips for, 319–320
  vegetables, 338–349
dual-purpose breeds, of chickens, 516, 517–518, 532–533
ducks, raising, 556–558

E

eagles, as predators to chickens, 548
Easter Egger chickens, 523
EFB (European foolbrood), 501–502
egg layers, 513, 515, 516, 518–523
eggplant
  for container planting, 22
  harvesting, 152
  planting guidelines for, 122
  pressure canning, 244
  side-dressing, 139
  succession planting, 150
  watering guidelines for, 128
eggs
  for baking bread, 428
  from chickens, 549–552
electric dehydrator, 320–322
electric fencing, 28
elevated hive stand, for beekeeping, 470–471
English walnut, 60
environmental considerations, for beekeeping, 458–459
equipment
  for beekeeping, 459, 467–472
  for canning, 185–191

  for extracting honey, 483–485
  for fermenting, 390–392
  for homebrewing, 372–373
  for pickling, 275
established plants, watering guidelines for, 126
European foolbrood (EFB), 501–502
everbearing strawberries, 61
extended harvest season, of vegetables, 42
extending growing seasons
  about, 171
  aeroponics, 179–180
  aquaponics, 179
  cold frames, 173–175
  covering rows, 172–173
  greenhouses, 175–178
  hydroponics, 178–179
  solar lighting, 176
exterior paneling, for chicken coops, 608
extracted honey, 483–485

F

fabaceae, 170
farming techniques, 145–151
fat, for baking bread, 428
fava beans, 147
feeding
  chickens, 529–536, 541–543
  seedlings, 111–112
fencing
  about, 86–87
  applying finish, 94
  building, 87–94
  for chicken coops, 610–611
  installing, 92–93
  installing posts, 88–89
  for keeping groundhogs out of garden, 30
fennel, 62
Fermented Garden Vegetables recipe, 399
fermenting
  about, 273, 389–390
  beverages, 416–424
  cleaning for, 392
  dairy, 405–415
  equipment for, 390–392
  pickling *versus,* 392
  sanitizing for, 393
  sourdough starter, 401–404
  sterilizing for, 393
  vegetables, 393–400
fertilizers
  chemical, 137
  choosing, 136
  organic, 136–137
  for vegetable gardens, 135–140
field corn, 51
field peas, 147
filtering, 376
fir wood, for building beehives, 583
fish, raising, 558
fish emulsion, 138
5-5-5 fertilizers, 136, 138
five-frame nuc (nucleus) hive, 466–467
flash tape, 33
flat braided wick, 443
flats, 105
flavonoids, 50
flavorings, for homebrewing, 377
flea beetles, 162
floating fruit, 296
floating row covers
  for controlling pests, 165
  for extending growing season, 172–173
flour, for baking bread, 426–427
flower gardens, 59
flowmeter, 79
Fluffy Dinner Rolls recipe, 436
foam skimmer, 186
foie gras, 556
foxes, as predators to chickens, 548
frame filter, for beekeeping, 470
frame rest, for beekeeping, 471–472
frass, 160
Freedom Ranger chickens, 525

freezer bags, 293
freezing
  about, 291
  blanching vegetables, 303–304
  fruit, 295–302
  headspace for, 192
  herbs, 316–317
  packaging foods for, 292–293
  refreezing, 295
  temperature, 292
  thawing, 294–295
  vacuum-sealing machines, 293
  vegetables, 303–315
fresh fruit, canning, 207–222
frost dates, 97–102
Froze Cauliflower recipe, 310
Frozen Apples Packed in Sugar recipe, 299
Frozen Bell Peppers recipe, 307
Frozen Broccoli recipe, 308
Frozen Brussels Sprouts recipe, 309
Frozen Corn recipe, 311
Frozen Greens recipe, 312
Frozen Peaches Packed in Syrup recipe, 301
Frozen Shelled Peas recipe, 313
Frozen Strawberries Packed in Sugar recipe, 302
Frozen Sumer Squash recipe, 314
Frozen Wax Beans recipe, 306
Frozen Winter Squash recipe, 315
fruit. *See also specific fruit*
  drying
    apples, 328, 330
    apricots, 328, 330
    blueberries, 329, 331
    cherries, 329, 332
    citrus, 329, 333
    pineapple, 329, 334
    puréed fruit, 329, 334–335
  freezing
    apples, 298, 299
    apricots, 298
    berries, 298, 300
    blueberries, 300
    citrus, 294
    nectarines, 298
    peaches, 298, 301
    strawberries, 298, 302
    tomatoes, 294–295
    watermelon, 294
  pretreating before drying, 326–327
  ripeness of, 208
fruit juice, lining jars with, 211
Fruit Leather recipe, 334–335
fruit pectin, 223–224
fruit-bearing trees, 59–60
fully composted, 77
fume board, 489
funnel, 190
furrows
  about, 79–80
  for planting seeds, 117
  for sowing seeds, 107

G

garden carts, 39
garden forks, 36–38
garden hoes, 35–36
garden planning
  about, 7–8
  assembling tools, 33–40
  determining location and size, 8–15
  keeping animals out, 26–33
  layouts, 15–19
  outside the garden bed, 19–26
garden projects, small
  about, 561
  A-frame trellis, 562–563
  cold frame, 567–568
  compost bin, 573–578
  rain barrel stand, 568–570
  raised garden beds, 565–567
  tomato cage, 563–565
  tool wall, 570–572
  walk-in hoop house, 578–580
garden rake, 38

garlic
  for companion planting, 168
  growing tips for, 56
  harvesting, 152
  preparing for cold storage, 366
Garlic Dilly Beans recipe, 400
gauges, for pressure canners, 235–236
geese, raising, 556–558
gel wax, 442–443
germinating mix, 106
germinating seeds, watering guidelines for, 126
ginger soda, 417
Ginger Soda recipe, 419–420
gloves, for beekeeping, 468–469
glycerin, as soap additive, 454
goat milk, 407, 555
goats, raising, 555–556
Golden Comet chickens, 521
gophers, keeping out of garden, 30–31
grain, for homebrewing, 374
grain moths, chickens and, 546
grass clippings, as mulch, 141
graywater systems, 86
green beans
  growing tips for, 49
  for rotating crops, 169
green manures, 145–146. *See also* cover crops
Green Tea Kombucha recipe, 423
Green Tomato Chutney recipe, 224, 226
green tomatoes, canning, 224
greenhouses, 175–178
greens
  for container planting, 22
  drying, 340, 345
  freezing, 305, 312
grelinette, 37–38
grit, for chickens, 534
grocery needs, supplementing your, 44
ground, transplanting to the, 114–116
ground fruit, 208
groundhogs, keeping out of garden, 30
grower pullet ration, 531–532
growing
  about, 125
  composting, 128–134
  farming techniques, 145–151
  fertilizing, 135–140
  length of season for, 97–102
  mulch, 140–145
  watering, 126–128
  when to harvest, 151–154
growing seasons, extending
  about, 171
  aeroponics, 179–180
  aquaponics, 179
  cold frames, 173–175
  covering rows, 172–173
  greenhouses, 175–178
  hydroponics, 178–179
  solar lighting, 176
gutters, 84–85

H

hair, for keeping deer out of garden, 29
hairy vetch, 147
half-high varieties, 60
Hamburg chickens, 520
hand cultivators, 35
hand dig and sift, 67
hand trowels, 34–35
hand-milled soap, 450–452
handpicking, for pests, 164
hardening off transplants, 113
hardware cloth, for chicken coops, 611
harvest season, extended, of vegetables, 42
harvesting
  honey, 485–495
  knowing when, 151–154
  rainwater in barrels, 84–85
hawks, as predators to chickens, 548
headspace
  for canning, 191–192
  for freezing, 192, 297

heat, providing for seeds, 108–109
heat days, 10–11
heavy soil, 14
heirloom varieties, 43
herbed butter, 317
herbicidal soap, 158
herbicides
  for fighting weeds, 157–158
  used on lawns, 141
herbs
  air-drying, 351
  drying
    chamomile, 350–352
    dill, 352–353
    mint, 353
    oregano, 353–354
    rosemary, 354
    sage, 355
    thyme, 355
  for fermenting, 391
  freezing
    basil, 316
    cilantro, 316
    parsley, 316
  growing, 62–63
  as a pickling ingredient, 271
  as soap additive, 454
heritage birds, 532–533
high-bush varieties, 60
high-rise composter, 130
hill planting, for seeds, 119
hive tool, for beekeeping, 470
hives, reversing bodies, 480–481
hoes, 35–36
home remedies, for controlling pests, 166
homebrewing
  about, 371
  adjuncts and flavorings, 377
  alcohol content, 375, 383
  bottling, 383–388
  cost of, 373
  hydrometer readings, 380–382
  ingredients for, 374–377
  setting up, 372–373
  step-by-step process of, 377–380
home-canning jars, 186–187
homemade repellent, for keeping deer out of garden, 29
Homemade Yogurt recipe, 410
homogenized milk, 406
honey
  about, 481–482
  equipment for extracting, 483–485
  expectations about, 482
honey bees, 460
honey extractors, 483
Honey Kombucha recipe, 424
honey press, harvesting honey with, 493–495
honey strainer, 484–485
honey supers, 487–489
honeydew melons, 47
Honey-Oatmeal Bread recipe, 434
hoop coops, 612–613
hops, for homebrewing, 374–375
horticultural oil, for controlling pests, 166
hoses
  about, 80
  harvesting rainwater, 85
  watering, 34
hot packing, 209, 213, 245, 246
humidity, for cold storage, 358
humus, 76
hybrid varieties, 43
hydrating chickens, 535–536
hydrometer, 375, 380–383
hydroponics, 178–179

I

iceberg lettuce, 52
icons, explained, 2–3
immortality elixir, 417
in hills, as planting arrangement, 16
in raised beds, as planting arrangement, 16
in rows, as planting arrangement, 15

indoor seedlings, transplanting, 112–116
indoors, starting, 103–104, 104–112
in-ground permanent sprinklers, 81
inorganic mulch, 142–144
insecticidal soap, for controlling pests, 166
installing
  fence posts, 88–89
  fencing, 92–93
Instant Pot
  for pressure canning, 233
  for water-bath canning, 200, 233
Integrated Pest Management (IPT), 506
intercropping, 148
Internet resources
  altitude levels, 242
  American Horticulture Society, 11
  beekeeping supply stores, 586
  call811, 15
  Cheat Sheet, 3
  city elevations, 206
  Complete Guide to Home Canning and Preserving, 211
  Joe Lamp'l (TV host), 563
  johnnyseeds, 579
  Nancy Jane's Stacking Planters, 25
  Seattle Public Utilities, 575
  smoker use for beekeeping, 470
  Sunset Map, 11
  Tower Garden, 179
  USDA Plant Hardiness Zone Map, 9
interplanting, 19
iodized salt, 270
IPM, 167
IPT (Integrated Pest Management), 506
iron fork, 36–37
iron rake, 38
Isa Brown chickens, 520–521

J

Jalapeño Salsa recipe, 229
jams, 223–224, 225
Japanese beetles, 162
jar lifter, 186
jar rack, 198–199
jars
  about, 201, 202
  lining with liquid when canning, 209–211
  reprocessing unsealed, 205
Jeff's Potato Bead recipe, 435
jelly bag, 190
jelly wax, 442–443
Jersey Giant chickens, 525
johnnyseeds (website), 579
juglone, 60
June-bearing strawberries, 61

K

K (potash), in fertilizer, 135–136
kale
  side-dressing, 139
  succession planting, 150
kefir, 405, 416, 417
Kefir recipe, 411
Kenyan top bar hive
  about, 463–464
  building, 587–601
kerf, 592
killing
  aggressive grasses, 67–68
  weeds, 67–68
Kimchi recipe, 398
kneading bread dough, 428–430
knotty pine, for building beehives, 582
kohlrabi, harvesting, 152
kombucha, 417
koumiss, 405
Koumiss recipe, 412

L

lactic acid, in vegetables for fermenting, 393
lactobacilli, 391
lactose, fermenting, 405
lamiaceae, 170

Lamp'l, Joe (TV host), 563
landscape fabric mulch, 144
Langsroth hive, 462, 489–492
lanolin, as soap additive, 454
lavender, 62
layer rations, for chickens, 531–532
layouts, for garden planning, 15–19
leaf crops, growing tips for, 52–54
leeks
  for companion planting, 168
  growing tips for, 57
  harvesting, 152
  planting guidelines for, 122
legal restrictions, for beekeeping, 459
leggy plants, 102
legumes, growing tips for, 48–49
lemon, as soap additive, 454
lemon juice, dipping fruit in before drying, 327
lettuce
  for container planting, 22
  freezing, 294
  growing tips for, 52
  harvesting, 152
  planting guidelines for, 122
  for rotating crops, 169
  side-dressing, 139
  succession planting, 150
  watering guidelines for, 128
lid wand, 189
lids, for two-piece caps, 187, 199, 201, 202
light, providing for seeds, 108–109
liliacaea, 170
lime, 73–75
lime juice, dipping fruit in before drying, 327
linoleum flooring, for chicken coops, 607
liquids, for baking bread, 428
livestock panels, 564
loam soil, 70
location, determining for garden, 8–15
lock-on cover, for pressure canners, 234
long-day onions, 57
low-acid foods, 232

M

malt, 374
malting process, 374
manure, 77
Maran chickens, 521–522
marigolds, for companion planting, 168
marine-grade (spar) varnish, for beehives, 587
marjoram, 62
markets, selling at, 44
mash, for chickens, 533
Mason jars, 188
MDF (medium-density fiberboard), for chicken coops, 607
meal worms, chickens and, 546
meat breeds, of chickens, 513, 516, 517, 523–525, 532–533
medicating bees, 498–499
medium-density fiberboard (MDF), for chicken coops, 607
melons
  for container planting, 22
  growing tips for, 47
  side-dressing, 139
  watering guidelines for, 128
melt-and-pour soap, 452
Mesclun greens, succession planting, 150
metal cored wick, 443
metal-to-metal cover, for pressure canners, 234–235
methods, of seed-planting, 116–119
mice
  chickens and, 545
  keeping out of garden, 31–32
microclimates, 11–12
microorganisms, 194
microsprinklers, 84
milk
  about, 406–407
  goat, 555
milky spore, 162
minitillers, 40
minks, as predators to chickens, 548

Minorca chickens, 520
mint
  drying, 353
  freezing, 316
  uses for, 63
Mite Away Quick Strips, 506
molded candles, 445–447
moon phases, planting by, 151
mortises, 89
mothballs, 32
mother, for sourdough starter, 401
mound, 119
mouthfeel, 374
Mozzarella cheese recipe, 415
mulch
  about, 140
  choosing, 144–145
  for fighting weeds, 157
  inorganic, 142–144
  organic, 140–142
  plastic, 142–144
mushrooms, pressure canning, 244
muskmelons
  growing, 47
  harvesting, 152
  planting guidelines for, 122
mustard greens, for companion planting, 168

N

N (nitrogen), in fertilizer, 135–136
Nancy Jane's Stacking Planters, 25
nasturtiums, for companion planting, 168
nectarines
  canning, 212, 217–218
  freezing, 298
neem oil, for controlling pests, 166
nematodes, 163
nest boxes, in chicken coops, 527–528
netting, 28
New Hampshire Red chickens, 521
nightshades
  peppers, 49–50, 51
  potatoes, 55
  tomatoes, 49–51
nitrogen (N), in fertilizer, 135–136
nominal dimensions, 583–584
Nosema, 499–500
no-till gardening, 78
no-till layered garden technique, 68
nut-bearing trees, 59–60
nutrients, adding with cover crops and green manures, 145–148
nutritional needs, of chickens, 530
nylon fencing, for chicken coops, 611

O

oatmeal, as soap additive, 454
okra
  harvesting, 152
  planting guidelines for, 122
olives, 51
OMRI (Organic Materials Review Institute), 129
onions
  for container planting, 22
  growing tips for, 56–57
  harvesting, 152
  planting guidelines for, 122
  preparing for cold storage, 366–367
  pressure canning, 249, 262–263
  side-dressing, 139
  watering guidelines for, 128
open-pollinated varieties, 43
opposums, as predators to chickens, 548
oregano
  drying, 353–354
  uses for, 62
organic fertilizers, 136–137
organic gardening, 75
Organic Materials Review Institute (OMRI), 129
organic matter, adding, 75–76

organic mulch, 140–142
oriented strand board (OSB), for chicken coops, 606
Orpington chickens, 518
OSB (oriented strand board), for chicken coops, 606
oscillating hoe, 35–36
overpressure plug, for pressure canners, 237
overwatering, 127
owls, as predators to chickens, 548

P

P (phosphate), in fertilizer, 135–136
paint, for beehives, 586–587
pallet gardening, 26
pallets, building compost bins from, 573–574
paper cored wick, 443
paraffin wax, 442
parsley
  freezing, 316
  planting guidelines for, 122
  uses for, 63
parsnips
  harvesting, 152
  planting guidelines for, 122
  pressure canning, 244
particle board, for chicken coops, 607
pasteurized milk, 406–407
paths, 18
pathways, 94
peaches
  canning, 212, 217–218
  freezing, 298, 301
peanuts, harvesting, 152
Pearl Leghorn chickens, 519
pears, preparing for cold storage, 367
peas
  for container planting, 23
  drying, 341, 346
  freezing, 305, 313
  growing tips for, 49
  harvesting, 152
  planting guidelines for, 122, 123
  pressure canning, 249, 264
  for rotating crops, 169
  side-dressing, 139
  succession planting, 150
  watering guidelines for, 128
peat moss, 142
peat plots, 105–106
pectin, 223–224
pelletized pulverized limestone, 74
pellets, for chickens, 533
peppers
  bell peppers, 248, 255, 304, 307
  for container planting, 23
  growing tips for, 49–50, 51
  harvesting, 152
  planting guidelines for, 122
  side-dressing, 140
  watering guidelines for, 128
perennial, 146
permanent raised bed, 16–17
pesticides, for controlling pests, 165–167
pests
  about, 155
  aphids, 159–160
  bad, 159–164
  caterpillars, 160–161
  chickens and, 544–546
  companion planting, 167–169
  corn earworms, 161
  cutworms, 161–162
  fighting, 164–170
  flea beetles, 162
  good, 158–159
  IPM, 167
  Japanese beetles, 162
  nematodes, 163
  resistance of vegetables, 42
  rotating crops, 169–170
  slugs, 163
  snails, 163
  spider mites, 163

  thrips, 164
  whiteflies, 164
  worms, 160–161
petcock, for pressure canners, 236–237
pH
  of food, 193–194
  of soil, 71, 73–77
pH factor, 232
phosphate (P), in fertilizer, 135–136
physical controls, for pests, 164–165
Pickled Asparagus recipe, 284
Pickled Brussels Sprouts recipe, 289
pickles, 275–276
pickling
  about, 269
  brining, 272–274
  equipment for, 275
  fermenting, 273, 392
  fermenting *versus,* 392
  ingredients for, 269–271
  maintaining crunch, 274
  troubleshooting, 277
  vegetables, 275–289
pine mulch, 141
pine wood, for building bee hives, 582
pineapple, drying, 329, 334
pipe vent, for pressure canners, 236–237
planter walls, 24
planting
  about, 95
  choosing seeds or transplants, 102–103
  companion, 167–169
  cover crops, 147–148
  guidelines for, 120–123
  by moon phases, 151
  plant size of vegetables, 42
  preparing for
    about, 65
    analyzing soil, 69–77
    fencing, 86–94
    improving soil, 69–77
    pathways, 94
    razing garden spot, 66–69
    turning soil, 77–78
    watering options, 79–86
  seed packet, 103–104
  seeding method, 103–104
  sowing seeds directly, 116–120
  spacing, 17–18
  starting indoors, 104–112
  succession, 148–150
  timing, 96–102
  transplanting indoor seedlings and starter plants, 112–116
  vertical, 19–21
planting arrangements, 15–16
plastic fencing, for chicken coops, 611
plastic mulch, 142–144
plumb bob, 87
Plymouth Rocks chickens, 518
plywood
  for building beehives, 584
  for building chicken coops, 605–606
polyurethane, for beehives, 587
popcorn, 52
portable-type sprinklers, 81
pot hangers, 24
potash (K), in fertilizer, 135–136
potatoes
  for container planting, 23
  drying, 341, 347
  freezing, 295
  growing tips for, 55
  harvesting, 152
  planting guidelines for, 122
  preparing for cold storage, 367
  pressure canning, 249–250, 265
  side-dressing, 140
  watering guidelines for, 128
pots, choosing, 105–106
potting soil, 106
powdered-sugar dusting, to control varroa mites, 505
power auger, 88

power tillers, 39–40
predators, chickens and, 546–548
pre-emergent herbicide, 158
premium pine, for building beehives, 582
preparing, for planting
  about, 65
  analyzing soil, 69–77
  fencing, 86–94
  improving soil, 69–77
  pathways, 94
  rasing garden spot, 66–69
  turning soil, 77–78
  watering options, 79–86
presprouting, 156
pressure canner, 185, 232–238
pressure canning
  about, 231
  choosing pressure canners, 232–238
  compared with water-bath canning, 198
  at higher altitudes, 242–243
  low-acid foods, 232
  recipes for vegetables, 250–267
  step-by-step process of, 238–242
  vegetables, 243–267
pressure cooker, 233
pressure-treated lumber, for chicken coops, 605
pretreating fruit, before drying, 326–327
probiotic, 390
pullets, 549
pulling weeds, 157
pulverized limestone, 74
pumice, as soap additive, 454
pumpkins
  harvesting, 152
  planting guidelines for, 123
  side-dressing, 140
  watering guidelines for, 128
puréed fruit, drying, 329, 334–335
Pyrethrins, for controlling pests, 166
pyrethroids, for controlling pests, 166

Q

Quick-Frozen Blueberries recipe, 300

R

rabbet, 592
rabbits
  keeping out of garden, 29–30
  raising, 554–555
rack, for pressure canners, 237–238
racoons
  keeping out of garden, 32
  as predators to chickens, 548
radishes
  for companion planting, 168
  for container planting, 23
  growing tips for, 56
  harvesting, 152
  planting guidelines for, 123
  for rotating crops, 169
  side-dressing, 140
  succession planting, 150
  watering guidelines for, 128
rain barrel stand, 568–570
rainwater, harvesting in barrels, 84–85
raised garden beds
  building, 565–567
  for seeds, 118–119
raised hill, 119
rake, 38
ramps, in chicken coops, 528
raspberries
  canning, 219
  tips for growing, 61
rats, chickens and, 545–546
raw milk, 406–407
raw pack, 209, 213
raw (cold) packing, 245–246
reactive metal, 198
rebate, 592

recipes
  Amish Applesauce Bread, 437
  Apple Pie Filling, 215
  Applesauce, 216
  autumn syrup, 477
  for baking bread, 432–440
  Basic White Buttermilk Bread, 433
  Blueberry Muffins, 439
  Buttermilk Biscuits, 440
  Canned Apples, 214
  Canned Apricots, Nectarines, and Peaches, 217–218
  Canned Asparagus, 251
  Canned Beets, 253–254
  Canned Bell Peppers, 255
  Canned Blueberries, 220
  Canned Carrots, 256–257
  Canned Corn, 258–259
  Canned Creamed Corn, 260–261
  Canned Fresh Green Beans, 252
  Canned Onions, 262–263
  Canned Peas, 264
  Canned Raspberries, 219
  Canned Summer Squash, 267
  Canned Sweet Potatoes, 266
  Canned Tomatoes, 221
  Canned White Potatoes, 265
  Chevre (goat cheese), 414
  for composting, 132
  Cottage Cheese, 413
  Dilly Beans, 285–286
  Dried Apples, 330
  Dried Apricots, 330
  Dried Beets, 343
  Dried Blueberries, 331
  Dried Carrots, 344
  Dried Cherries, 332
  Dried Citrus Peel, 333
  Dried Greens, 345
  Dried Peas, 346
  Dried Pineapple, 334
  Dried Potatoes, 347
  Dried Shell Beans, 342
  Fermented Garden Vegetables, 399
  Fluffy Dinner Rolls, 436
  Frozen Apples Packed in Sugar, 299
  Frozen Bell Peppers, 307
  Frozen Broccoli, 308
  Frozen Brussels Sprouts, 309
  Frozen Cauliflower, 310
  Frozen Corn, 311
  Frozen Greens, 312
  Frozen Peaches Packed in Syrup, 301
  Frozen Shelled Peas, 313
  Frozen Strawberries Packed in Sugar, 302
  Frozen Sumer Squash, 314
  Frozen Wax Beans, 306
  Frozen Winter Squash, 315
  Fruit Leather, 334–335
  Garlic Dilly Beans, 400
  Ginger Soda, 419–420
  Green Tea Kombucha, 423
  Green Tomato Chutney, 224, 226
  Homemade Yogurt, 410
  Honey Kombucha, 424
  Honey-Oatmeal Bread, 434
  Jalapeño Salsa, 229
  Jeff's Potato Bead, 435
  Kefir, 411
  Kimchi, 398
  Koumiss, 412
  Mozzarella cheese, 415
  Pickled Asparagus, 284
  Pickled Brussels Sprouts, 289
  for pressure canning, 250–267
  Quick-Frozen Blueberries, 300
  Root Beer, 421
  Sauerkraut, 396
  Sourdough Starter, 403
  Southern Corn Bread, 438
  Speedy Dill Pickles, 276, 280–281
  Spiced Pickled Beets, 287–288
  Spinach Sauerkraut, 397
  Strawberry-Rhubarb Jam, 225

recipes *(continued)*
  Summer Squash Relish, 227–228
  Sweet Pickle Relish, 278–279
  Sweet Potato Crunch Sticks, 348
  Tomato Paste, 222
  Traditional Sourdough Starter, 404
  Vanilla Cinnamon Coconut Kefir, 422
  for water-bath canning fresh fruit, 211–222
  Zucchini Bread and Butter Pickles, 276, 282–283
  Zucchini Chips, 349
Red Ranger chickens, 525
Red Star chickens, 521
red wiggler worm, 134
redwood, for chicken coops, 605
refreezing, 295
rehydrating, 328, 339
relish, 275, 278–279
Remember icon, 3
repellents
  for keeping deer out of garden, 29
  for keeping groundhogs out of garden, 30
resources, Internet
  altitude levels, 242
  American Horticulture Society, 11
  beekeeping supply stores, 586
  call811, 15
  Cheat Sheet, 3
  city elevations, 206
  Complete Guide to Home Canning and Preserving, 211
  Joe Lamp'l (TV host), 563
  johnnyseeds, 579
  Nancy Jane's Stacking Planters, 25
  Seattle Public Utilities, 575
  smoker use for beekeeping, 470
  Sunset Map, 11
  Tower Garden, 179
  USDA Plant Hardiness Zone Map, 9
Rhode Island Red chickens, 521
Rhode Island White chickens, 521
rhubarb
  growing tips for, 58
  harvesting, 153
  planting guidelines for, 123
rip, 92
ripeness, of fruit, 208
rising, for bread, 430–431
rock salt, 270
Roma tomatoes, 50
Romaine lettuce, 52
roofing felt paper, for building beehives, 585
roofing materials, for building beehives, 585–586
roost, in chicken coops, 527
root ball, 112
root beer, 417
Root Beer recipe, 421
root cellar, 357, 359. *See also* cold storage
root crops, growing tips for, 54–57
root zone, 14
root-bound plants, 102
rosemary
  drying, 354
  uses for, 63
rotating crops, 169–170
rototiller, 77–78
row covers
  for extending growing season, 172–173
  for keeping deer out of garden, 28
row planting, for seeds, 117
rubber trash cans, for cold storage, 362
rug strips mulch, 144
runs, in chicken coops, 528
rutabagas
  harvesting, 153
  pressure canning, 244
rye, winter, 147
ryegrass
  for companion planting, 168
  as a cover crop, 146

S

Sacbrood, 500
safety, canning and, 191–195
sage
  drying, 355
  uses for, 63
'Salad Bush' cucumber, 46
salt
  for baking bread, 428
  for fermenting, 391
  as a pickling ingredient, 270
sandy soil, 70
sanitizing, for fermenting, 393
Sauerkraut recipe, 396
savory, 63
savoy, 52
saw kerf cut, 592
sawdust, 142
scab, 55
scare tactics, for keeping deer out of garden, 28
scare tape, 33
scarecrow, 33
SCOBY (symbiotic colony of bacteria and yeast), 418
scratch feed, for chickens, 533
screening materials, for building beehives, 586
screens, 85
screw bands, for two-piece caps, 188, 199, 201, 202
Seattle Public Utilities (website), 575
seed packet, 103–104
seed potatoes, 55
seeding method, 103–104
seedless watermelons, 47
seedling leaves, 109
seedlings
  feeding, 111–112
  thinning, 120
  watering, 109–110, 126
seeds
  choosing, 102–103
  sowing, 107–108, 116–120
  sowing directly, 116–120
  thinning indoors, 111
  transplanting indoors, 111
select pine, for building beehives, 582
selecting
  cover crops, 146–147
  fertilizers, 136
  hives, 461–467
  mulch, 144–145
  pots, 105–106
  seeds, 102–103
  transplants, 102–103
self-rising flour, 427
self-watering seed starting kits, 110
selling, at markets, 44
semi-savoy, 52
shaking bees, 488
shallots, harvesting, 153
shell beans, drying, 340, 342
shingles, for chicken coops, 609
short-day onions, 57
shovels, 36
show breeds, 517
side-dressing, 137–140
siding, for chicken coops, 608
size, determining for garden, 8–15
sketching plans, 18–19
slugs, 163
small-scale crops, 58–62
smoker, for beekeeping, 469–470
snails, 163
snap beans. *See* beans
soaker-hose irrigation, 82
soap, for keeping deer out of garden, 29
soap making
  about, 441, 450
  additives, 452–454
  hand-milled soap, 450–452
  melt-and-pour soap, 452
sod, stripping, 69
soil
  adjusting pH, 73–77
  analyzing, 69–77
  cultivating, 157

soil *(continued)*
  drainage of, 14–15
  improving, 69–77
  pH of, 71, 73–77
  solarizing, 156–157
  testing, 71–73
  turning, 77–78
  types of, 70–71
soil labs, 72
solanaceae, 170
solar lighting, 176
solarizing soil, 156–157
solid-strap connection, 36
sour cream, 405
sourdough starter, 401–404
Sourdough Starter recipe, 403
Southern Corn Bread recipe, 438
Southern peas, planting guidelines for, 123
southernwood, for companion planting, 168
sowing
  seeds, 107–108, 116–120
  seeds directly, 116–120
space, requirements for chickens, 511
spacing plantings, 17–18
spades, 36
spading fork, 36–37
spatula, thin plastic, 189
Speedy Dill Pickles recipe, 276, 280–281
Spiced Pickled Beets recipe, 287–288
spices
  for fermenting, 391
  as a pickling ingredient, 271
spider mites, 163
spinach
  growing tips for, 52
  harvesting, 153
  planting guidelines for, 123
  side-dressing, 140
  succession planting, 150
  watering guidelines for, 128
Spinach Sauerkraut recipe, 397
Spinosad, for controlling pests, 165
spoiled food, 194–195
sprays, for keeping deer out of garden, 29
spring, beekeeping during, 478–479
sprinklers, 81–82
sprinkling, for rehydrating, 328
spruce wood, for building beehives, 583
square braided wick, 443
square foot method, 150
squash
  for container planting, 23
  harvesting, 153
  planting guidelines for, 123
  for rotating crops, 169
  side-dressing, 140
  summer
    canning, 227–228
    freezing, 305, 314
    growing tips for, 47–48
    harvesting, 153
    planting guidelines for, 123
    pressure canning, 249–250, 267
    side-dressing, 140
    watering guidelines for, 128
  watering guidelines for, 128
  winter
    freezing, 305, 315
    growing tips for, 48
    harvesting, 153
    planting guidelines for, 123
    side-dressing, 140
squirrels, keeping out of garden, 32
stacking planters, 25
stairwells, for cold storage, 359–360
standard pine, for building beehives, 582
starter, for fermenting, 391
starter plants
  buying, 112–113
  transplanting, 112–116
starter rations, for chickens, 531
steam blanching, 327

steam canning, 199
steam pressure gauge, for pressure canners, 236
steaming, for rehydrating, 328
steam-pressure canner, 185
stem crops, growing tips for, 57–58
stem lettuce, 52
sterilizing, for fermenting, 393
stings, from bees, 460–461
stirrup hoe, 35–36
Stonebrood, 500–501
stoneware crocks, 190–191
storage
  characteristics of vegetables, 42
  cold
    about, 357
    finding, 357–362
    preparing foods for, 364–368
    root cellar, 359
    rubber trash cans, 362
    rules for, 362–364
    stairwells, 359–360
    storm shelters, 360
    straw-bale storage, 361–362
  eggs, 551–552
storm shelters, for cold storage, 360
straddling containers, 24
strainer, 190
straw-bale storage, for cold storage, 361–362
strawberries
  canning, 212
  freezing, 298, 302
  tips for growing, 61–62
Strawberry-Rhubarb Jam recipe, 225
stripping sod, 69
subsistence-level operation, 45
succession planting, 19, 148–150
sugar, for fermenting, 391
sugar syrup, 209–211
sulfur, 73–75
summer, beekeeping during, 474–475
summer oil, for controlling pests, 166
summer squash
  canning, 227–228
  freezing, 305, 314
  growing tips for, 47–48
  harvesting, 153
  planting guidelines for, 123
  pressure canning, 249–250, 267
  side-dressing, 140
  watering guidelines for, 128
Summer Squash Relish recipe, 227–228
sun
  for drying food, 323–324
  exposure to, 13–14
Sunset Map, 11
surfaced posts, 89
swarming, in beekeeping, 496–498
sweet corn
  growing, 51
  succession planting, 150
Sweet Pickle Relish recipe, 278–279
Sweet Potato Crunch Sticks recipe, 348
sweet potatoes
  drying, 348
  harvesting, 153
  planting guidelines for, 123
  pressure canning, 249–250, 266
sweeteners, for baking bread, 427
Swiss chard
  planting guidelines for, 123
  side-dressing, 140
  watering guidelines for, 128
symbiotic colony of bacteria and yeast (SCOBY), 418
synthetic miticide chemicals, 506
syrup concentrations, for freezing, 296–297

T

table salt, 270
tansy, for companion planting, 168
tapers, 447–449
tarragon, 63

taste, of vegetables, 42
Technical Stuff icon, 3
temperature
  for cold storage, 358
  for freezing, 292
tempering, 187
temporary raised bed, 16–17
ten-forty-eight, 383
testing soil, 71–73
thawing, 294–295
thinning
  seedlings, 120
  seeds indoors, 111
three-pronged hand cultivator, 35
thrips, 164
thyme
  drying, 355
  uses for, 63
tillers, 39–40, 77–78
time
  for fermenting, 392
  requirements for chickens, 511
timing
  feeding chickens, 534
  planting, 96–102
tined hoe, 35
Tip icon, 2
tomato cage, 563–565
tomato paste, 213
Tomato Paste recipe, 222
tomatoes
  buying plants, 112
  canning, 213, 221, 222, 226
  for container planting, 23
  freezing, 294–295
  growing tips for, 49–51
  harvesting, 153
  planting guidelines for, 123
  preparing for cold storage, 368
  for rotating crops, 169
  side-dressing, 140
  watering guidelines for, 128
tool wall, 570–572
tools, assembling for gardening, 33–40
top bar hive, 492–493
top-fermenting strain, 376
torque twisting, 89
Tower Garden, 179
tractor coops, 613–614
Traditional Sourdough Starter recipe, 404
transplanting
  to the ground, 114–116
  indoor seedlings, 112–116
  seeds indoors, 111
  starter plants, 112–116
transplants
  choosing, 102–103
  hardening off, 113
  watering guidelines for, 126
Transylvanian Naked Neck chickens, 518
trapping, for controlling pests, 165
true leaves, 109
tubers, growing tips for, 54–57
tumbler composter, 130
Turken chickens, 518
turkeys, raising, 558
turning soil, 77–78
turnips
  harvesting, 153
  planting guidelines for, 123
  preparing for cold storage, 368
  pressure canning, 244
  watering guidelines for, 128
two-piece caps, 187–188, 199, 201, 202

U

U-fork, 37–38
ullage, 386
ultra-pasteurized milk, 406
unbleached white flour, 427
uncapping knife, 484
USDA Plant Hardiness Zone Map, 9–10

V

vacuum-sealing machines, 293, 325
Vanilla Cinnamon Coconut Kefir recipe, 422
varroa mites, 502–506
vegetable-based wax, 443
vegetables. *See also specific vegetables*
  blanching, 303–304
  cleaning for pressure canning, 244–245
  container, 21–23
  cool-season
    frost dates for, 97
    mulch for, 144–145
    planting, 96
  drying
    beans, 340, 342
    beets, 340, 343
    carrots, 340, 344
    peas, 341, 346
    potatoes, 341, 347
    shell beans, 340, 342
    sweet potatoes, 348
    zucchini, 341, 349
  fermenting, 393–400
  fertilizing gardens, 135–140
  freezing
    beans, 304, 306
    bell peppers, 304, 307
    broccoli, 304, 308
    Brussels sprouts, 304, 309
    cauliflower, 305, 310
    corn, 305, 311
    cucumbers, 294
    lettuce, 294
    peas, 305, 313
    potatoes, 295
    summer squash, 305, 314
    winter squash, 305, 315
  herbs, 62–63
  hot packing, 245, 246
  how much to grow, 43–45
  not recommended for pressure canning, 244
  pickling
    asparagus, 276, 284
    beans, 276, 285–286
    beets, 277, 287–288
    Brussels sprouts, 277, 289
    cucumbers, 275–276
  pressure canning, 243–267
  raw (cold) packing, 245–246
  selecting for pressure canning, 243
  small-scale crops, 58–62
  thawing, 294
  tips for, 45–58
  varieties of, 41–43
  warm-season
    frost dates for, 97
    mulch for, 145
    planting, 96–97
  watering guidelines for, 127
veils, for beekeeping, 468
vent tube, for pressure canners, 236–237
ventilation
  of chicken coops, 526
  for cold storage, 358
  for hives, 497–498
vermicomposting, 134
vertical containers, 23–26
vertical planting, 19–21
vinegar
  as a pickling ingredient, 270–271
  as weed killer, 158
vinyl flooring, for chicken coops, 607
vitamin E oil, as soap additive, 454
voles, keeping out of garden, 31–32

W

waffle beds, 17
wagons, 38, 39
walk-in coops, 615–616
walk-in hoop house, 578–580
wall hanging pocket gardens, 24–25
walnuts, 60

warm-season vegetables
  frost dates for, 97
  mulch for, 145
  planting, 96–97
Warning icon, 3
Warré (people's) hive, 464–466
water
  for chickens, 535–536, 541–543
  for homebrewing, 376–377
  lining jars with, 211
  as a pickling ingredient, 271
water blanching, 326–327
water-bath canner, 185, 198
water-bath canning
  about, 197–198
  accompaniments, 224, 226–229
  adjusting for altitude, 206–207
  for fresh fruit, 207–222
  in Instant Pot, 200
  jams, 223–224, 225
  low-acid foods, 232
  preparing for, 198–199
  recipes for fresh fruit, 211–222
  reprocessing unsealed jars, 205
  steam canning, 199
  step-by-step process of, 200–206
watering
  about, 79, 126
  basins, 80
  drip irrigation, 82–84
  furrows, 79–80
  graywater systems, 86
  guidelines for, 126–127
  harvesting rainwater in barrels, 84–85
  hoses, 80
  seedlings, 109–110
  soaker-hose irrigation, 82
  sprinklers, 81–82
watering hoses/cans, 34
watermelon
  freezing, 294
  harvesting, 153
  planting guidelines for, 123
wax, for candlemaking, 442–443
weasels, as predators to chickens, 548
websites
  altitude levels, 242
  American Horticulture Society, 11
  beekeeping supply stores, 586
  call811, 15
  Cheat Sheet, 3
  city elevations, 206
  Complete Guide to Home Canning and Preserving, 211
  Joe Lamp'l (TV host), 563
  johnnyseeds, 579
  Nancy Jane's Stacking Planters, 25
  Seattle Public Utilities, 575
  smoker use for beekeeping, 470
  Sunset Map, 11
  Tower Garden, 179
  USDA Plant Hardiness Zone Map, 9
weeds
  about, 155–156
  fighting after planting, 157
  fighting before planting, 156–157
  herbicides, 157–158
  killing, 67–68
weevils, chickens and, 546
weighted gauge, for pressure canners, 236
welded wire, for chicken coops, 611
Welsummer chickens, 522
wet pack with sugar, 296
wet pack with syrup, 296
wheat germ, as soap additive, 454
wheelbarrows, 39
white clover, for companion planting, 168
White Leghorn chickens, 519

white-egg layers, 519–520
whiteflies, 164
whole-grain mixtures, for chickens, 533
whole-wheat flour, 427
wicks, for candlemaking, 443–444
wide row planting, for seeds, 117–118
wide-mouth canning funnel, 190
wilting, 127
winter, beekeeping during, 476–478
winter rye, 147
winter squash
  freezing, 305, 315
  growing tips for, 48
  harvesting, 153
  planting guidelines for, 123
  side-dressing, 140
wire composter, 130
wire mesh, for chicken coops, 607
wood, for building beehives, 582
wood and wire thee-bin composter, 574–578
worms
  composting and, 134
  as pests, 160–161
wormwood, for companion planting, 168
Wyandotte chickens, 518

Y

yams, pressure canning, 249–250
yeast
  for baking bread, 425–428
  for homebrewing, 375–376
yogurt, 405

Z

zoning restrictions, for beekeeping, 459
zucchini
  drying, 341, 349
  growing, 47
Zucchini Bread and Butter Pickles recipe, 276, 282–283
Zucchini Chips recipe, 349

About the Authors

Todd Brock has written, directed, and produced more than 1,000 hours of television programming. His shows on topics ranging from landscaping to home renovations to organic gardening have aired across the US on major networks, including HGTV, DIY Network, and PBS, and locally in one of the country's Top 10 TV markets. The series "Growing a Greener World," for which Todd is scriptwriter and consulting producer, recently won a Southeast Emmy. As a freelance writer, Todd's work as a food writer has appeared on the popular website Serious Eats and in print in one of Atlanta's most recognized publications. He is a regular contributor to *Cowboys Wire,* covering sports news for fans of the Dallas Cowboys. He is the author of several *Dummies* books, including *Building Chicken Coops For Dummies.* When he is not writing, Todd competes in the sport of obstacle-course racing. He lives in the suburbs of Atlanta with his wife, Debbie, and their two daughters, Sydney and Kendall.

Bob Beckstrom is a licensed general contractor, living in northern California. He enjoys building things, spending time outdoors, and sharing what he's learned with other people. His first building experience was as a VISTA volunteer in 1968, as the coordinator of a self-help housing project in rural Alaska. He taught elementary school for ten years; has taught adult courses in house building and remodeling at The Owner Builder Center in Berkeley, California; and has written and edited extensively on home-improvement topics, including *Decks & Patios For Dummies*.

Howland Blackiston has been a backyard beekeeper since 1984. He's written many articles on beekeeping and appeared on dozens of television and radio programs (including The Discovery Channel, CNBC, CNN, NPR, Sirius Satellite Radio, and scores of regional shows). He has been a featured speaker at conferences in more than 40 countries. Howland is the past president of Connecticut's Back Yard Beekeepers Association, one of the nation's largest regional clubs for the hobbyist beekeeper. He is also the author of *Building Beehives For Dummies,* the companion book to this one, providing detailed instructions in how to build hives from scratch. Howland, his wife, Joy, and his bees live in Easton, Connecticut.

Cathy Cromell is the Southwest regional reporter for the National Gardening Association (NGA). She completed the Master Composter and Master Gardener certification programs at the University of Arizona Maricopa County Cooperative Extension Urban Horticulture Department in Phoenix, where she also absorbed abundant hands-on experience hoisting tons of organic matter while overseeing the composting area of the Master Gardener Demonstration Garden. As editor of Arizona Master Gardener Press at the Cooperative Extension, Cathy produced gardening books that received numerous awards. She was also a writer for *Better Homes and Gardens New Garden Book* and a contributing writer for *Gardening in the Southwest* (Sunset Books).

Rik DeGunther attended the University of Illinois as an undergraduate and Stanford University as a graduate student, studying both applied physics and engineering economics (some of this education actually stuck!). He holds several United States patents and is one of those nerdy guys who likes to take things apart to see how they work and then put them back together and try to figure out what the leftover parts are for. Rik is CEO of Efficient Homes, an energy efficiency auditing firm in Northern California. He also writes weekly op-ed columns for the *Mountain Democrat,* California's oldest and most venerable newspaper.

Suzanne DeJohn has worn a variety of hats during her years with the National Gardening Association, including work in the education, editorial, and IT departments. She coordinated NGA's online question and answer service for six years and has answered literally thousands of gardening questions. Convinced that gardeners are curious and love to learn, she was inspired to create the *Exploring the Garden* series of in-depth, online courses that teach the principles of botany in the context of the garden. Suzanne also does web- and print-based graphic design work for NGA, takes photos for the websites, and creates illustrations to accompany articles.

Owen Dell is an internationally recognized and widely admired expert in sustainable landscaping. He has written numerous articles for *Sunset Magazine, National Gardening Magazine, Southern California Gardener, Pacific Horticulture,* and many others. He's an international speaker who has presented hundreds of truly rousing lectures, classes, and workshops to homeowners and professionals. Owen is also the co-writer and co-host of the popular Santa Barbara, California, television series *Garden Wise Guys,* a sustainable-landscaping sitcom. His other book, *How to Start a Home-Based Landscaping Business* (Globe Pequot), has helped thousands of budding professionals get a healthy start on their careers. Owen's work has been featured on HGTV, Peak Moment Television, and NBC and in *The Wall Street Journal, Fortune* magazine, *Landscape Architecture Magazine,* the *Los Angeles Times,* and many other publications. He has won numerous awards for his work.

Kelly Ewing is a writer and editor who lives in the wonderful community of Fishers, Indiana, with her husband Mark, her daughter Katie, her son Carter, and furry canine friend Cheyenne. She has coauthored several books, including *The Internet All in One Desk Reference For Dummies, PCs All in One Desk Reference For Dummies,* and *Direct Mail For Dummies.* She has ghostwritten several books and edited more than 75 books on a variety of topics. She also writes articles on sports, travel, and human interest for several newspapers. In her spare time — when she can find it! — she enjoys spending time with her kids, reading, walking, writing, scrapbooking, cooking, and doing crafts.

Philip Giroux is a second-generation Californian who developed his desire for planting and his love of gardens watching his father, an avid gardener, and graduated from the University of Arizona with a degree in landscape architecture and ornamental horticulture. He established his landscape designing and building firm in 1978, specializing in custom residential installations, including the estates of Rupert Murdock and Henry Mudd. Philip is responsible for numerous large-scale commercial projects, such as the Los Angeles County Museum of Arts Sculpture and Japanese Pavilion Garden. Philip has served as L.A. Chapter President for the California Landscape Contractors Association and is a member of the Royal Horticulture Society.

Theresa A. Husarik is a writer, photographer, crafter, fiber person, and animal lover who lives on a small plot far away from the heart of the city. When she is not tending to her brood (which includes llamas, alpacas, angora goats, cats, dogs, peacocks, and chickens), she can usually be found either behind the computer writing something or in the craft room making something.

Amy Jeanroy has been canning and preserving foods for 20 years. She is passionate about filling the pantry with useful, delicious foods, and creating healthy meals from her own small farm. Amy is the Herb Garden Guide for About.com and also writes a weekly farm newsletter that provides homemade recipes to help her readers store and use their summer bounty.

Rob Ludlow, his wife, Emily, and their two beautiful daughters, Alana and April are the perfect example of the suburban family with a small flock of backyard chickens. What started out as a fun hobby raising a few egg-laying hens has turned into almost an addiction. Originally, Rob started posting his experiences with chickens on his hobby website, but when he realized how much his obsession with chickens was growing, he concentrated his efforts on a site completely devoted to the subject. Now Rob owns and manages `www.BackYardChickens.com` (BYC), the largest and fastest-growing community of chicken enthusiasts in the world.

The National Gardening Association (NGA) is committed to sustaining and renewing the fundamental links between people, plants, and the earth. Founded in 1972 as “Gardens for All” to spearhead the community garden movement, today’s NGA promotes environmental responsibility, advances multidisciplinary learning and scientific literacy, and creates partnerships that restore and enhance communities. NGA is best known for its garden-based curricula, educational materials, international initiatives, and several youth garden grant programs. Together, these reach more than 300,000 children nationwide each year. NGA’s websites, one for home gardeners and another for those who garden with kids, build community and offer a wealth of custom content.

Marty Nachel is a freelance writer on beer and brewing. As a member of the North American Guild of Beer Writers, in September 1996 Marty was voted one of the three best beer writers in the United States at the N.A.G.B.W. Quill & Tankard Awards at the Great American Beer Festival in Denver. A former President of the Chicago Beer Society and founding member of the Brewers Of South Suburbia (B.O.S.S.) homebrew and beer appreciation club, Marty has been brewing his own award-winning beers since 1985. In 1986, he was the first person in the state of Illinois to become a Certified Beer Judge. In addition to his homebrew judging duties, Marty served on the panel of beer evaluators at the prestigious Beverage Testing Institute in Chicago, home of the World Beer Championships, as well as the Great American Beer Festival in Denver, Colorado. His articles have appeared in *All About B*eer magazine, *Brew Magazine, Brew Your Own* magazine, *Celebrator Beer News, Drink* magazine, *Fine Cooking* magazine, *Zymurgy Magazine,* and Epicurious.com.

Charlie Nardozzi is a nationally recognized garden writer, speaker, and radio and television personality. He has worked for more than 20 years bringing expert gardening information to home gardeners through radio, television, talks, online, and the printed page. Charlie has written for national magazines such as *Organic Gardening* and contributed to many of the *For Dummies* gardening titles, authoring *Vegetable Gardening For Dummies.* He also authored the *Ultimate Gardener* (HCI Press) which highlights heart-warming stories about the trials and tribulations of gardening and *Northeast Fruit and Vegetable Gardening* in (Cool Springs Press). He also contributed to other book project such as *Vegetables from an Italian Garden* (Phaidon Press). Charlie's skills as a garden communicator extend beyond the printed page. He's the former host of PBS's *Garden Smart*, reaching more than 60 million households. He has also been a gardening expert on many national syndicated television and radio shows such as HGTV's *Today at Home*, Discovery Channel's *Home Matters*, Sirius Radio's *Martha Stewart Living*, and *Garden Life Radio.*

Emily Nolan has loved baking for as long as she can remember. Her earliest memories are of digging in her mother's huge tubs of flour as she put together pies and breads. Her mother handed Emily scraps of dough to keep her busy — even at that tender age, Emily had baking in her blood. Today. Emily does freelance editing, recipe writing, and recipe development.

Paul Simon is a nationally recognized landscape architect, public artist, horticulturist, master gardener, and urban designer. Paul brings a wealth of knowledge, skills, and abilities from various fields in the gardening, horticulture, and design industries. He holds a B.S. in Landscape Architecture from the University of Kentucky with a diverse curriculum in site design, urban design, community planning, geography, architecture, plant and soil sciences, forestry, and civil engineering. He is also an esteemed member of the American Society of Landscape Architects. In addition, Paul is involved as a horticultural editor for `www.kidsgardening.org`. Kids Gardening is a leading national provider of K-12, plant-based educational materials, providing programs and initiatives for plant-based education in schools, communities, and backyards across the country. Paul continues to provide unique articles underscoring the importance of kids gardening and outdoor learning.

Cheryl K. Smith has raised goats since 1998 when she got two Nigerian Dwarves. She published *Ruminations, the Nigerian Dwarf and Mini Dairy Goat Magazine* from 2001 through 2007 and published the book *Goat Health Care* (Karmadillo Press) in 2009. She has written for *Dairy Goat Journal, Countryside,* and other magazines. Cheryl served as legal counsel for the American Goat Society (AGS) from 2003 to 2005 and on their board of directors from 2005 to 2009. She has also served on the boards of the American Nigerian Dwarf Dairy Association (ANDDA), the Northwest Nigerian Dwarf Dairy Goat Association (NNDDGA) and the Northwest Dairy Goat Herd Improvement Association (NDGHIA). Cheryl lives in the community of Low Pass, located in the coast range of Oregon, with her herd of experimental miniature dairy goats, Mystic Acres Oberians.

Lance Walheim has been gardening most of his life. He got his start when his father forced him to turn the soil and plant tomatoes in the family vegetable garden as punishment for a deed he can't recall. Funny thing was, he found that he enjoyed working in the soil and has been doing it ever since. He has written or contributed to more than 40 gardening books on subject ranging from citrus to roses (including *Roses For Dummies*). He has also written extensively about lawns and lawn care – check out his book, *Lawn Care For Dummies*. He also has served as a writer for *Sunset* and *National Gardening* magazines and is part owner of California Citrus Specialties, marketers of specialty citrus fruit. But his true loves are family and gardening, the "composts" that enrich his heart and soul.

Karen Ward is the author of *Pickles, Peaches, and Chocolate* and a life-long home canner, home economist, and recipe developer. In addition to judging preserved food at the San Diego County Fair each year, Karen teaches canning and preserving to men and women of all ages. Karen has been a featured guest on many television shows, including QVC and HGTV's *Smart Solutions*. She is a founding member of the San Diego Chapter of Les Dames d'Escoffier International, a non-profit organization mentoring women and providing scholarships in the culinary arts. Karen is a native-born Southern Californian. She makes her home in San Diego with her husband, Chris.

Marni Wasserman is a certified chef and culinary nutritionist who uses passion and experience to educate individuals on how to adopt a realistic, plant-based diet that is both simple and delicious. She is dedicated to providing individuals with balanced lifestyle choices through organic, fresh, whole, and natural plant-based foods. As a prominent figure of health and nutrition in Toronto, Marni is a contributor to *Chatelaine, Huffington Post, Bamboo,* and *Tonic Magazine.* She has made several TV appearances on CBC and CTV, and has been featured in the *Toronto Star.* Marni has also consulted with the Windsor Arms Hotel for its vegan and vegetarian menus, and she participates in several live speaking and cooking demonstrations. If that isn't enough, she is also the author of several well-received plant-based e-books such as *Cleansing with Super Foods* and *Veggin' Comfortably.*

Ann Whitman earned a Bachelor of Science degree in Plant and Soil Science at the University of Vermont. She also completed a Master of Arts degree in Landscape Design from the Conway School of Landscape Design in Massachusetts. Ann is the author of *Trees and Shrubs For Dummies* (Wiley Publishing, Inc.) as well as *How-To Landscaping Basics* and *Water Gardens: Simple Steps to Adding the Beauty of Water to Your Garden,* both published by Time Life. She also contributes to several gardening magazines and websites. When she's not writing, Ann gardens on fertile river-bottom soil in Vermont where the winters are long and the summers are short but worth it.

Kimberley Willis lives with her husband, Steve, on a small farm in the thumb area of Michigan. She is now retired and enjoying her grandchildren, her chickens, and gardening. Kim worked at the MSU Extension office in Lapeer County Michigan for 18 years as a horticulturist and doubled as the resident chicken expert. She has raised numerous breeds of chickens and other poultry for eggs, meat, and showing for more than 40 years. She is a strong advocate of eating locally and shares her bounty of eggs with family and friends. Kim is a proud member of `www.backyardchickens.com/` and is also a member of the Huron County Michigan Fowl Group on Facebook. In addition, Kim is a garden and country living writer for Examiner.com and has written more than 600 articles online.

Dave Zook, his wife, Suz, and their four children, Justin, Jordan, Jenika, and Javon, live on several acres in rural Lancaster County, Pennsylvania. He is the founder/owner of Horizon Structures, a manufacturer of pre-built storage sheds, garages, horse barns, and chicken coops. Dave and his family keep a small flock of chickens at home in one of his company's coops. He continues to improve the designs and develop new ones based on customer input as well as his family's experiences with their own backyard flock. Over the past nine years, Horizon's line of chicken coops has proven to be very popular with chicken fanciers — and their hens — throughout the U.S., with coops now in 48 states!

Publisher's Acknowledgments

Executive Editor: Lindsay Lefevere
Development Editor: Susan Pink
Copy Editor: Susan Pink
Editorial Assistant: Matthew Lowe
Sr. Editorial Assistant: Cherie Case

Production Editor: Magesh Elangovan
Cover Image: © Daxiao Productions/Shutterstock

Take dummies with you everywhere you go!

Whether you are excited about e-books, want more from the web, must have your mobile apps, or are swept up in social media, dummies makes everything easier.

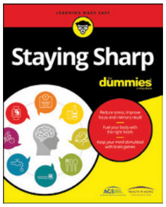
facebook
I AM A DUMMIE
For Dummies
25 YEARS OF LEARNING MADE EASY
TEN TIPS ON HOW TO START A SMALL BUSINESS

Find us online!

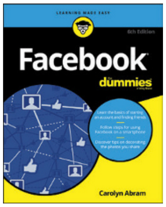
dummies.com

dummies®
A Wiley Brand

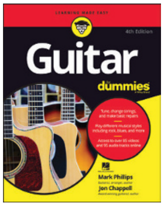
PERSONAL ENRICHMENT


Staying Sharp
dummies

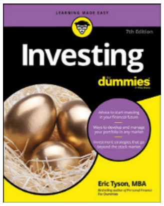
9781119187790
USA $26.00
CAN $31.99
UK £19.99


Facebook
dummies
Carolyn Abram

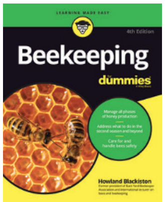
9781119179030
USA $21.99
CAN $25.99
UK £16.99


Guitar
dummies
Mark Phillips
Jon Chappell

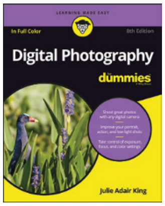
9781119293354
USA $24.99
CAN $29.99
UK £17.99


Investing
dummies
Eric Tyson, MBA

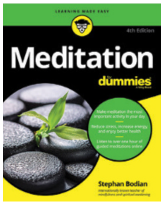
9781119293347
USA $22.99
CAN $27.99
UK £16.99


Beekeeping
dummies
Howland Blackiston

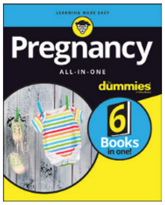
9781119310068
USA $22.99
CAN $27.99
UK £16.99


Digital Photography
dummies
Julie Adair King

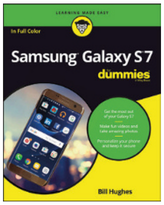
9781119235606
USA $24.99
CAN $29.99
UK £17.99


Meditation
dummies
Stephan Bodian

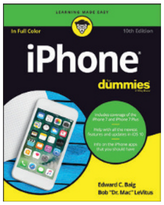
9781119251163
USA $24.99
CAN $29.99
UK £17.99


Pregnancy
ALL-IN-ONE
dummies
6 Books in one!

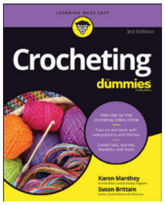
9781119235491
USA $26.99
CAN $31.99
UK £19.99


Samsung Galaxy S7
dummies
Bill Hughes

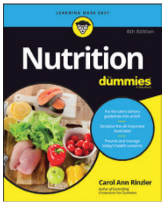
9781119279952
USA $24.99
CAN $29.99
UK £17.99


iPhone
dummies
Edward C. Baig
Bob "Dr. Mac" LeVitus

9781119283133
USA $24.99
CAN $29.99
UK £17.99

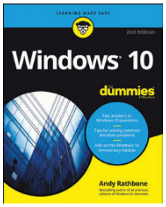

Crocheting
dummies
Karen Manthey
Susan Brittain

9781119287117
USA $24.99
CAN $29.99
UK £16.99

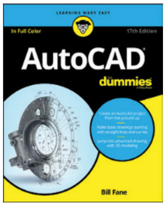

Nutrition
dummies
Carol Ann Rinzler

9781119130246
USA $22.99
CAN $27.99
UK £16.99

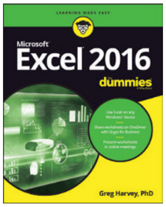
PROFESSIONAL DEVELOPMENT


Windows 10
dummies
Andy Rathbone

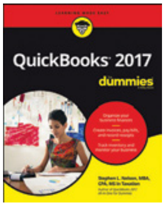
9781119311041
USA $24.99
CAN $29.99
UK £17.99


AutoCAD
dummies
Bill Fane

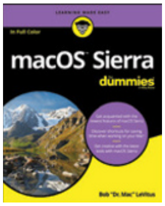
9781119255796
USA $39.99
CAN $47.99
UK £27.99


Excel 2016
dummies
Greg Harvey, PhD

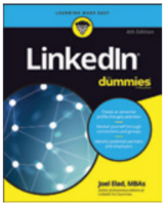
9781119293439
USA $26.99
CAN $31.99
UK £19.99


QuickBooks 2017
dummies
Stephen L. Nelson, MBA, CPA, MS in Taxation

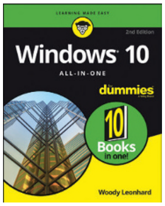
9781119281467
USA $26.99
CAN $31.99
UK £19.99


macOS Sierra
dummies
Bob "Dr. Mac" LeVitus

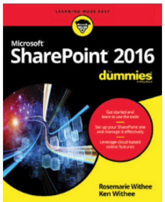
9781119280651
USA $29.99
CAN $35.99
UK £21.99


LinkedIn
dummies
Joel Elad, MBA

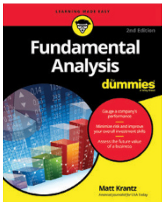
9781119251132
USA $24.99
CAN $29.99
UK £17.99


Windows 10
ALL-IN-ONE
dummies
10 Books in one!
Woody Leonhard

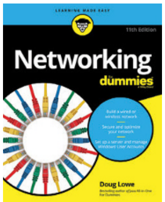
9781119310563
USA $34.00
CAN $41.99
UK £24.99


SharePoint 2016
dummies
Rosemarie Withee
Ken Withee

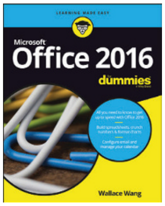
9781119181705
USA $29.99
CAN $35.99
UK £21.99


Fundamental Analysis
dummies
Matt Krantz

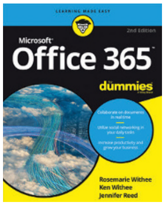
9781119263593
USA $26.99
CAN $31.99
UK £19.99


Networking
dummies
Doug Lowe

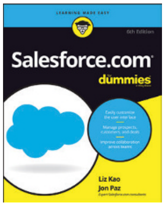
9781119257769
USA $29.99
CAN $35.99
UK £21.99


Office 2016
dummies
Wallace Wang

9781119293477
USA $26.99
CAN $31.99
UK £19.99


Office 365
dummies
Rosemarie Withee
Ken Withee
Jennifer Reed

9781119265313
USA $24.99
CAN $29.99
UK £17.99


Salesforce.com
dummies
Liz Kao
Jon Paz

9781119239314
USA $29.99
CAN $35.99
UK £21.99

Coding
dummies
Nikhil Abraham

9781119293323
USA $29.99
CAN $35.99
UK £21.99

dummies.com

dummies®
A Wiley Brand

WILEY END USER LICENSE AGREEMENT

Go to www.wiley.com/go/eula to access Wiley’s ebook EULA.